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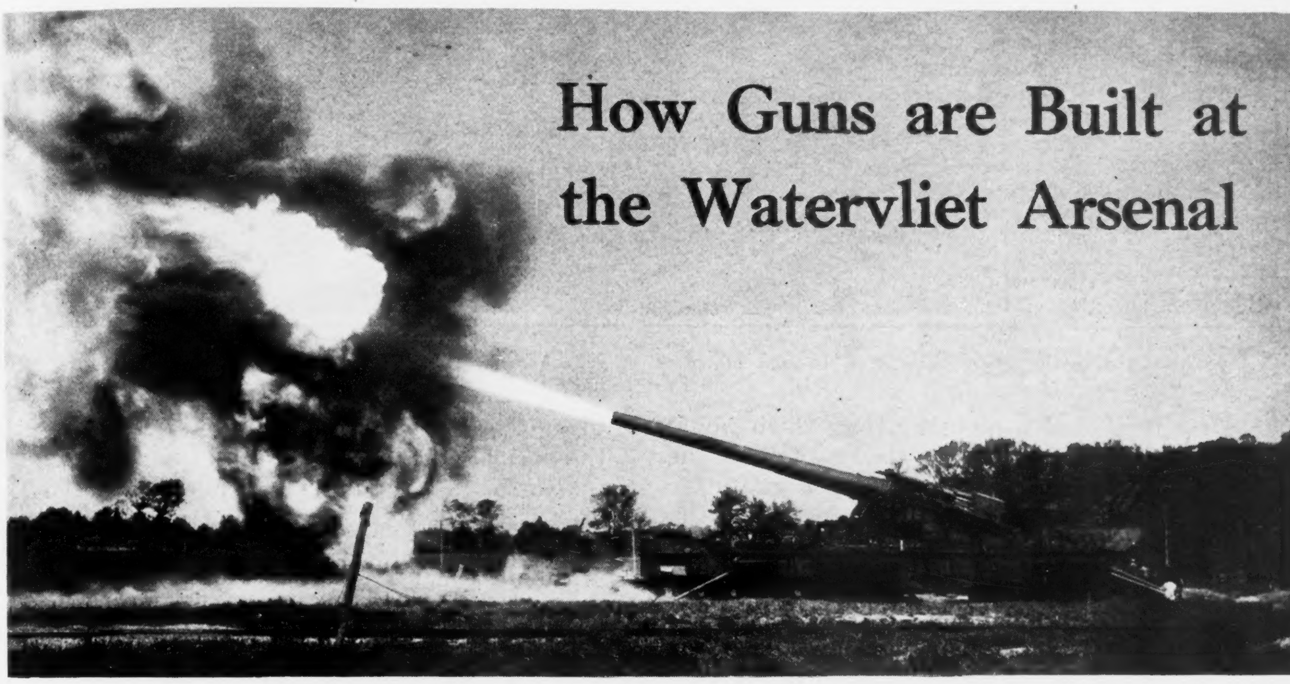


How Guns are Built at the Watervliet Arsenal

Machine Shop Operations in Constructing Guns by which Twenty-four Hundred Pound Projectiles are Shot a Distance of Thirty-one Miles

By CHARLES O. HERB

OLD methods of carrying on warfare were revolutionized by the memorable encounter between the first armored turret ship, the *Monitor*, and the iron-clad *Merrimac*. A singular circumstance of this engagement was that not one shot fired by either vessel penetrated the armor of the other. The guns of the *Merrimac*, which had wrought such terrific havoc on the wooden frigates of the Union fleet, were unable to inflict serious damage on the 8-inch iron armor of the *Monitor*, while the 11-inch guns of the latter could not pierce the improvised armor of the Confederate vessel.

Not only did this naval engagement on March 9, 1862, mark the opening of a new era—the era of the armored battleship—but it also emphasized the futility of using cast single-piece bronze or iron guns against ships protected by iron armor. The first 8-inch built-up guns subsequently constructed in this country could readily penetrate backed-up iron armor 8 inches thick, or modern casehardened steel armor 6 inches thick, at a range of 1000 yards. Today, all large guns are either of the built-up or of the wire-wound type.

All cannon for the War Department are produced at the Watervliet Arsenal, Watervliet, N. Y., complete with breech mechanisms but without carriages. Guns ranging in size from 37 millimeters (1.4567 inches) to 16 inches, are built. This article will describe interesting machine shop operations in constructing 14- and 16-inch guns. The 16-inch guns fire a projectile weighing 2400 pounds through a distance of 31 miles. These guns are 68 feet 10 inches long from the muzzle to the end of the breech block, and weigh 197 tons without the breech mechanism. Some large guns are also made for the Navy Department at the Watervliet Arsenal.

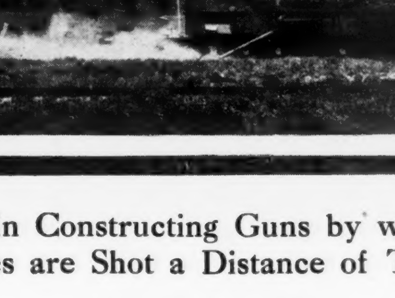


Fig. 1. Cross-sectional View of a Built-up Gun

The Theory of Built-up Guns

In discharging a projectile, a gun is subject to two fundamental stresses, a circumferential tensile stress, which tends to split the gun open longitudinally, and a tensile stress, which tends to pull the gun apart lengthwise. The longitudinal strength of a gun is usually greatly in excess of requirements, and so, in designing a gun, particular attention is paid to insure adequate circumferential strength.

The pressure that a cast gun

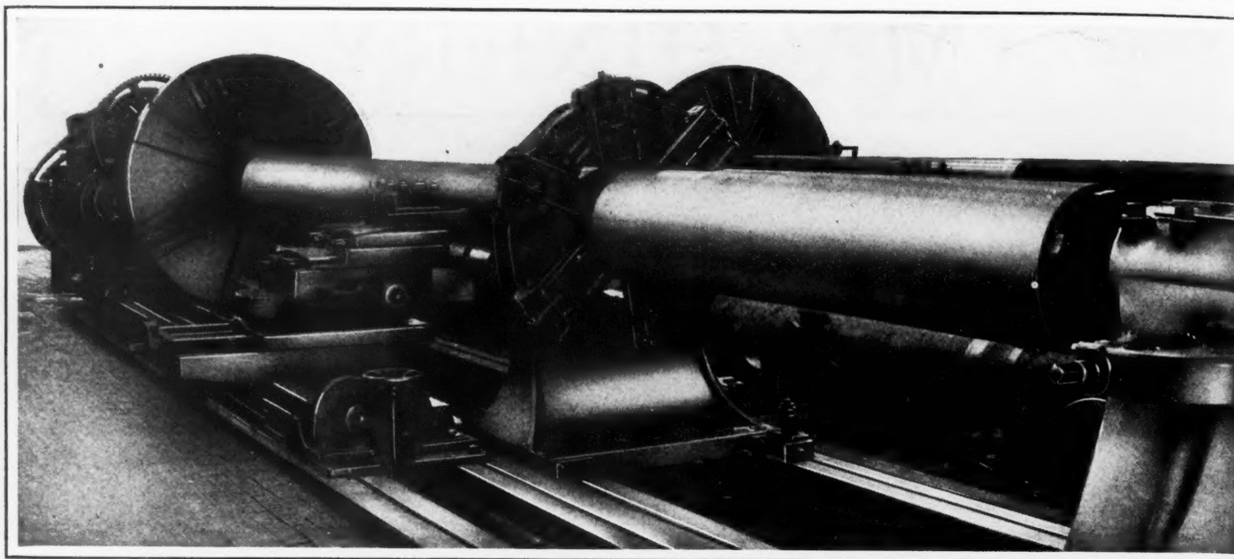


Fig. 2. Turning the Main Tube of a 16-inch Howitzer in a Lathe that may be Extended to Receive Forgings 70 Feet Long

can safely withstand is less than that which would expand its inner fibers to the elastic limit of the metal. It is useless to merely thicken a gun after a certain thickness has been reached, due to the fact that the stresses on the metal near the bore are far higher than those on the metal of the outer portion of the gun, and hence the metal at the bore soon reaches its maximum resistance, which the added thickness of metal does not materially increase.

If, however, a cast gun could be compressed until its inner fibers reached their elastic limit for compression, the strength of the gun would be practically doubled, since a pressure could be introduced to bring these fibers from the state of compression to the normal state and then up to the elastic limit for expansion. It is on this principle that the built-up gun is based.

Fig. 3. Lowering a 16-inch Gun into the Electric Heating Furnace

Fig. 1 shows a cross-sectional view through a typical built-up gun, taken about one-fifth the distance from the breech end. It will be seen that the gun consists of a main tube *A* which extends the entire length of the gun. This tube is surrounded by a number of hoops or jackets, such as *B* and *C*. Two hoops, which are locked together, entirely encase the main tube from the breech end to the muzzle end, but the outer hoops do not extend the full length of the gun.

The different hoops are shrunk on the main tube, one by one, after they have been finish-bored. Finally the entire gun is shrunk on the liner *D*, which extends the full length of the gun within the main tube. The hoops assembled adjacent to the main tube are bored to diameters slightly smaller than the corresponding surfaces of the tube and, therefore, as the hoops shrink with cooling, they compress the fibers of the tube until these fibers reach the elastic limit for compression. Likewise, the outer hoops, such as represented by *C*, compress the fibers of the inner hoops. Liner *D* is assembled last in the main tube by shrinkage. A shoulder in the tube prevents the liner from being forced out of the gun when the gun is fired. The theoretical maximum strength of the built-up method of construction is approached as the number of hoops is increased. Gun forgings are mainly made of nickel steel having a tensile strength of 95,000 pounds per square inch.

All Major Forgings are "Telltaled"

Important gun body forgings, upon their receipt at the Arsenal, undergo a "telltaling" operation to determine whether or not there is sufficient metal to permit the part to be machined to the specified dimensions. This inspection is performed by placing the forging in a lathe, with one end in a chuck and the other in a revolving steadyrest. The exterior of the forging is made to run true by adjusting the chuck and rest jaws. Then the bore is inspected by means of a "telltale," which consists of

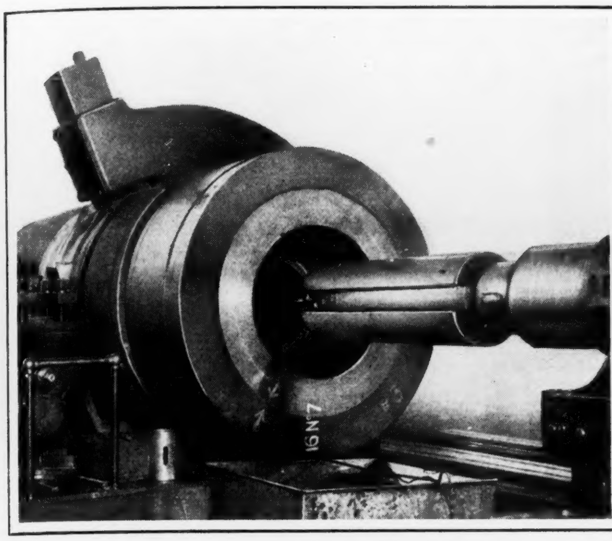


Fig. 4. Tool Employed in Finish-boring One of the Cylindrical Zones of the Main Tube

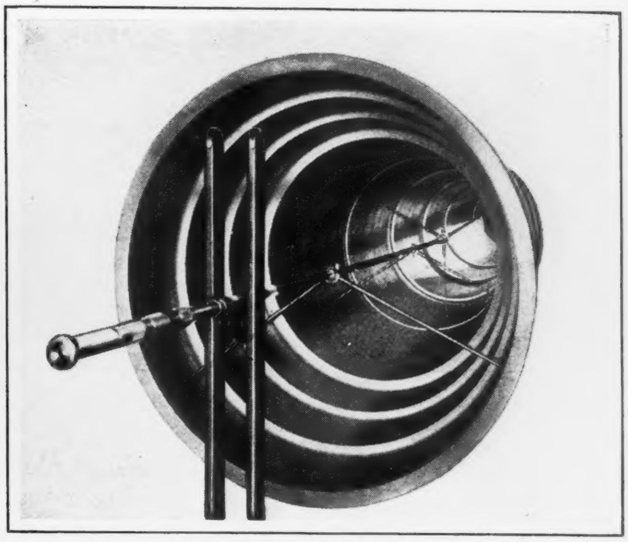


Fig. 5. Star-gaging a Large Gun Hoop along Every Inch of its Length

a light wooden pivoted beam somewhat longer than the forging. On the forward end of this beam there is a vertical steel point which is held in contact with the top of the bore. A sheet-metal pointer fastened to the rear end of the beam rests on the flat side of an ordinary machinist's scale that is mounted vertically. With this arrangement, it is an easy matter to check the concentricity of the bore at any point along its length.

The practice is to take four readings, 90 degrees apart, on the circumference of the bore at fixed distances throughout its length. Generally the front end of the beam is moved forward one foot for each set of readings. When the bore of the forging has been completely inspected as described, and the readings indicate that the bore can be machined to the specified dimensions, spots of a prescribed width and diameter are turned on the exterior of the gun part. These spots are later used to set up the part for boring, turning, and reaming. Should the irregularity shown by the readings be greater than permitted by the amount of stock to be removed, it becomes necessary to readjust the forging by means of the chuck and steadyrest jaws and again "telltale." Very long forgings, such as tubes and liners, must be "telltaled" from both ends, and have to be reversed in the chuck to complete the operation.

Boring the Main Tube

When the main-tube forging is received at the Arsenal, the bore has four diameters. To prepare for assembling the liner, the bore must be machined to have four separate tapered zones, each decreasing in size toward the muzzle. The first operation on the main tube after "telltaling" consists of rough step-boring the various zones of the bore to a cylindrical shape. This operation is performed with the tube mounted in a lathe, the muzzle end being held in the headstock chuck and the breech end in a steadyrest, the jaws of which bear on a spot turned at the end of the "telltaling" operation.

The free or breech end of the forging is first counterbored for a depth of about 4 inches to the diameter of the boring tool to be used, so as to furnish a surface for piloting the boring tool. Then the boring tool is carefully keyed to the front end of a bar that is fully as long as the gun and fed into the gun until the first step or shoulder is reached. The boring-bar is mounted in bearings spaced on a bed that extends away from the tailstock end of the lathe bed, in direct line with the lathe centers. The distance from the left-hand end of the headstock on a boring lathe to the right-hand end of the boring bed is approximately 165 feet.

The amount of stock removed in the rough boring may be as much as 5/8 inch on one side of the gun and only enough on the opposite side to true up the surface. A finish-boring cut is then taken with another tool of increased diameter, which removes approximately 0.050 inch on each side of the bore, or 0.100 inch on the diameter. Mineral lard oil is fed in large quantities to the cutters at a pressure of about 20 pounds per square inch.

An unusual feature of these boring operations is

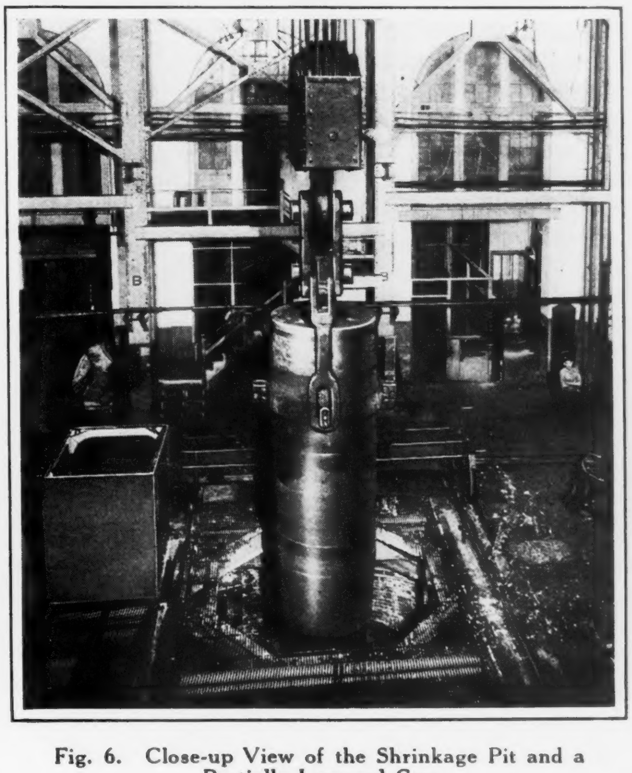


Fig. 6. Close-up View of the Shrinkage Pit and a Partially Lowered Gun

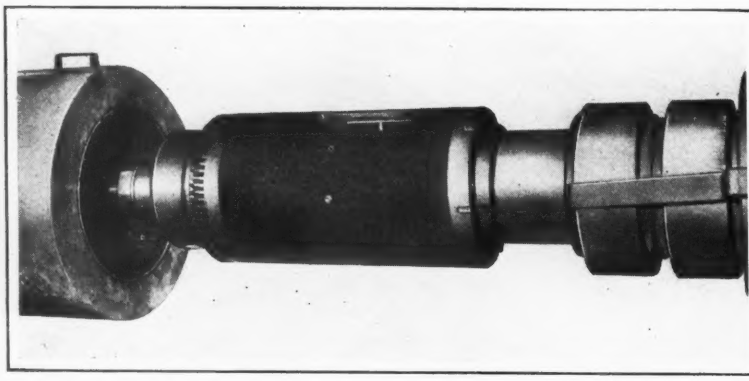


Fig. 7. Tool Employed for Cutting the Rifling Grooves by a Large Number of Successive Passes

the construction of the tools employed. Fig. 4 illustrates the tool used in taking the second cut; that employed for the first cut is identical, with the exception of the cutter blades. Each cutter blade is mounted on a large flat iron or steel casting, which has a taper shank at the rear end for attachment to the boring-bar. Both sides of the casting are fitted with well seasoned oil-impregnated hard maple blocks which are turned to a diameter slightly greater than the diameter across the cutter blades, so as to insure a firm fit of the wooden blocks in the bore to be produced. This fit is absolutely essential, as the wooden blocks serve as a pilot which practically controls the direction of the boring cutters. The cutters of the roughing tool have cutting edges on the forward end at right angles to the axis of the bore, while the cutters of the finishing tool have the cutting edges on the side. These cutting edges are slightly tapered on the forward end so as to take a gradual cut.

For boring the second or next smaller zone of the main tube, a tool is prepared in the usual manner, with the wooden blocks turned to the size of this zone. A number of narrow hard maple strips are then nailed on the wooden blocks, and these strips are turned to fit the bore of the first zone. In starting to bore the second zone, these strips align the tool with the previously machined larger zone, and as the ends of the strips come in contact with the shoulder, after the cutters have entered the second zone, the copper nails that hold the strips to the wooden blocks are sheared off. The strips are thus left behind in the larger bore, leaving the wooden blocks themselves free to guide the tool in the second zone. The finishing tool for the second zone is used in a similar manner.

In boring the third and fourth zones of the main tube, strips are again nailed to the wooden blocks to guide the tools from the previously machined second and third zones, respectively. However, since the third and fourth zones are a considerable distance along the gun, some sagging of the boring-bar would ordinarily occur unless additional support were provided. Hence, following rings are supplied on the boring-bar in back of the tool. These rings are bored to a slip fit on the bar and are turned about 0.01 inch smaller in diameter than the bore in which they are used.

After taking each roughing cut in a zone, the bore is again "telltaled" to insure that it is true. When an error exists, another roughing tool must be made of a size that will straighten out that zone with the smallest possible amount of enlargement. A roughing tool must straighten the bore, as the finishing tool has a tendency to follow the path already prepared. A smooth finish is necessary in the four zones of the bore at this time, so that the compression that will be produced in assembling each hoop may be determined by means of star-gage measurements.

After the gun has been completely built up without the liner, the main tube is again step-bored and then taper-reamed, as will be described later. The various hoops or jackets are bored in the same manner as the main tube; however, the number of steps depends on the length of the forging. The largest hoop of a 16-inch gun has a finished bore 53 inches in diameter. In boring the liner, tools of the same diameter are used for the entire length of the part.

Each Bore is Star-gaged Every Inch of Its Length

After the finish-boring operation, each member is carefully inspected along the bore by means of the star gage illustrated in Fig. 5. This instrument has three measuring points at the forward end which are employed to take readings 120 degrees apart on the bore at intervals of 1 inch along the entire length of the bore. The outer end of this instrument is equipped with a micrometer device for accurately determining each measurement. Readings must be carefully taken and recorded, because they are used as a basis for making a "shrinkage" drawing which specifies the diameters to which the corresponding surfaces of the adjacent hoop or tube are turned. Diameters are specified for each inch along the length of the surfaces to be turned, so as to insure accurate fitting of the parts in the shrinkage operations. Due allowance is made, in prescribing the different diameters, for the compression that occurs with shrinkage.

Each machined bore is also carefully inspected

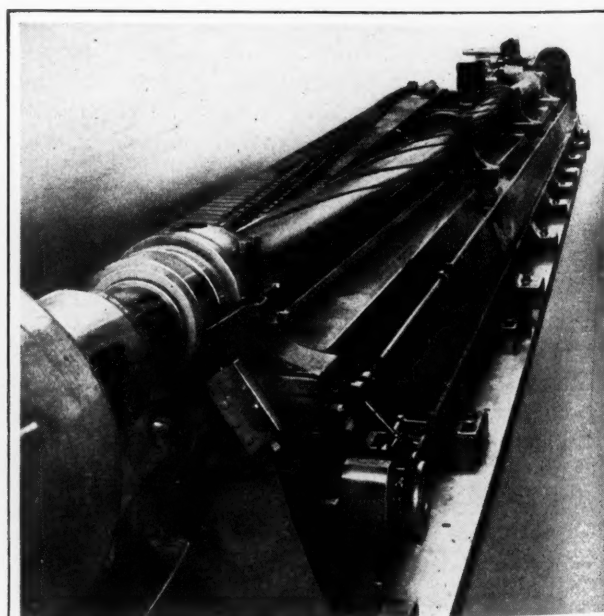


Fig. 8. View of the Rifling Bar and Bed Employed for Producing the Rifling Grooves in Liners

for defects by means of a mirror and electric light so fastened to the forward end of a long slender pole that even the longest liners or tubes may be readily observed from the ends of the part.

Turning Operations on Gun Parts

In turning main tubes, liners, and hoops, a set-up such as illustrated in Fig. 2 is employed, the part being held in the headstock chuck at one end and in a steadyrest near the opposite end. In taking the roughing cuts, the steadyrest unit is usually stationary, but this steadyrest unit is allowed to revolve during finishing cuts so as to minimize chatter. Two tools are used at a time in the rough-turning, and one in the finishing cut. The operator must carefully follow the "shrinkage" drawing already referred to.

Performing the Shrinkage Operations

The process of shrinking the hoops on the main tube and on each other is of considerable interest. Each hoop is heated to a predetermined temperature, varying from 400 to 850 degrees F., depending upon the desired shrinkage, the diameter of the bore, and the thickness of the hoop wall. The temperature is also governed by the over-all length of the part and by the longitudinal position of the shoulder contact in the bore.

Heating of the parts is accomplished in an electric furnace built into a pit beneath the floor. This furnace is comprised of thirteen sections, each about 6 feet 10 inches high. Two thermo-couples are provided for each furnace section, on opposite sides, and thus the temperature of each section can be closely observed and regulated. The gun parts are, of course, suspended vertically in the furnace. They are conveniently raised and lowered by means of an overhead crane.

The member on which a heated hoop is to be assembled is held vertically in a shrink pit which is approximately 108 feet deep, the part being so suspended that water for cooling it can be applied to the interior to prevent it from becoming heated too rapidly by the hoop. The male part is covered with a very thin coat of graphite and oil to facilitate the assembly.

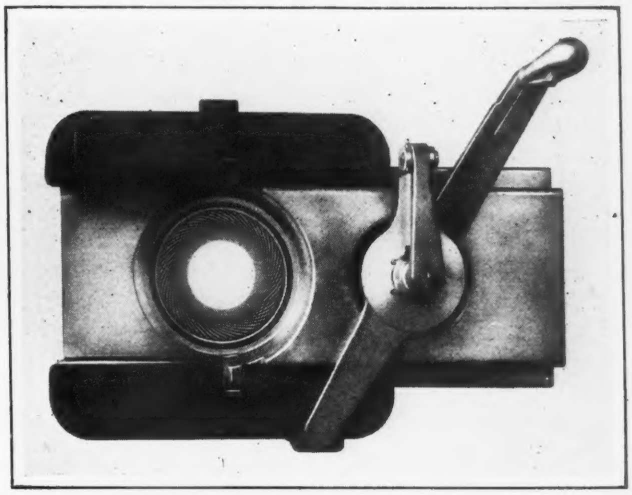


Fig. 10. Close-up View of a Trench Mortar, Showing Rifling Grooves and Lands

When the hoop to be assembled is removed from the electric furnace by means of an overhead crane, its interior diameter is measured at both ends to insure that the part has expanded the desired amount. Then the hoop is moved into position over the male member, carefully centered, and lowered into place. Water is immediately applied to the outside of the hoop, as close as possible to the location of the interior contact shoulder, by means of a circular pipe which surrounds the hoop. Several of these water rings are employed during the cooling operation.

After the water has been turned on successively through these rings in their original position, all of them, with the exception of the first ring, which constantly remains at the contact shoulder, are raised a foot at a time at intervals of approximately one minute. The outer hoop is thus brought gradually into contact with the inner member by this cooling process. It is absolutely necessary that the outer hoop grip the internal member first at the contact shoulder, as otherwise the outer member would tend to rise and become longitudinally mislocated. The heated part, of course, shortens in length at the same time as it contracts circumferentially.

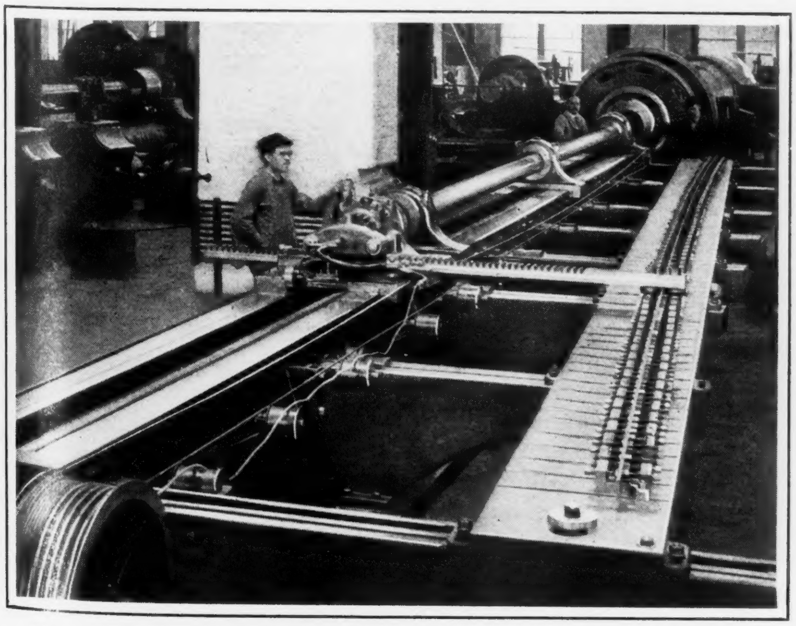


Fig. 9. Employing a Flexible Bar or Ribbon for Generating the Rifling Grooves in a Large Gun

In cooling some of the larger hoops on a 16-inch gun, as much as 55,000 gallons of water are used, and the cooling operation occupies almost one hour. The temperature of 850 degrees F. is much higher than is necessary for actual assembly of any of the members, but the additional clearance afforded by the increased temperature keeps the heated hoop from gripping the inner part above the water rings before they are lifted, as mentioned in the preceding paragraph. In shrinking on the largest hoop of a 16-inch gun, the hoop is heated until it has expanded 0.222 inch, whereas the required shrinkage is about 0.018 inch.

Shrinking on Liners

Liners are assembled after all the hoops have been shrunk on the main tube and the latter part has been taper-reamed. The assembly of liners is facilitated by the taper of the main-tube seat and of the external liner surface, so that the gun need not be heated to anywhere near the high temperature used in assembling the hoops. For heating preparatory to the assembly of the liner, the gun is lowered into the electric furnace with the breech end uppermost.

The liner is prepared for assembly by having the bore threaded at each end to receive plugs for retaining water that is circulated in the liner after it has been lowered into the heated gun. The liner is filled with water before being lowered into the gun, which remains in the furnace. As soon as the liner is seated in the gun, a connection is made to an inlet pipe in the breech plug and water is turned on, the excess water escaping through overflow pipes. At the same time, a hydraulic equipment, which has been suspended from another crane, is brought over the furnace and attached to the gun to exert a pressure of 200 tons on the liner, thus firmly holding it on its seat in the main tube.

The instant that pressure is exerted by the hydraulic equipment, a valve is operated to lower the water level in the liner and thus permit a certain amount of the upper liner portion to take on the heat of the gun. At proper intervals, other valves are opened to successively reduce the water level until the entire external liner surface has come into contact with the heated main tube. In this process, the liner becomes expanded within the main tube and is firmly gripped as the entire unit contracts in cooling.

Taper-reaming the Liner Seat

After a gun has been completely built up, with the exception of the liner, the main tube is once more step-bored in preparation for reaming the liner seat. In this step-boring, the four cylindrical zones are enlarged and the three shoulders carried forward sufficiently to leave just the right amount of stock at the rear of each shoulder for the taper reamers to clean up. Two tools similar to those employed in the preliminary boring are used in each zone in this final step-boring operation. Then the zones are split up into twelve shorter zones by means of boring tools similar to those already described, with the exception that the cutters are mounted on the rear end of the tools.

In taper-reaming the liner seat in a 16-inch gun, twelve reamers are used, varying from 45 to 80 inches in length, the total length of the seat being about 800 inches. The taper in the liner seat is 0.003 inch per inch of length. The reamer bodies are identical with those of the boring tools previously described, except that they are equipped with a short pilot carrier on the front end. A cutting blade made in sections is mounted the full length of the tool along opposite sides of the reamer in pockets cut out in the reamer body. Impregnated maple blocks are again bolted to the body casting for the full length of the tool and turned to the required taper. The pilot ring on the front of the reamer is turned to fit the cylindrical zone that is to be taper-reamed.

In the operation, the reamer is held centrally by the pilot ring and by following rings behind the tool. When the pilot approaches the shoulder of the next zone in front of that being reamed, the reamer is withdrawn, the pilot ring removed, the reamer cleaned, and honed if required, and then fed to the proper distance from the end of the tube. Each successive zone is reamed in the same manner. Great care must be taken to insure that each reamer is stopped the correct distances from the end of the tube, and this is accomplished so accurately that visual inspection or measurements cannot detect where adjacent cuts join.

Finishing Holes by Milling

Many machine parts—automobile hubs may be mentioned as an example—have several bores of different diameters and a number of faces or shoulders that must be finished within close limits of accuracy relative to each other. A most efficient method developed within recent years for finishing such surfaces simultaneously by milling will be described in the leading article in December MACHINERY. Threads can be milled at the same time as other cylindrical surfaces. Tapered holes can be milled and threads cut on tapered surfaces by the milling process. External surfaces of different diameters can also be finished by means of the process to be described.

Finish-boring the Gun

Finish-boring of the liner is done after its assembly, in practically the same manner as the preliminary boring. However, in this operation, the bore must be produced within plus 0.001 inch of its prescribed size for the entire length of the gun. One roughing and one finishing reamer are used, each of these tools being of the same type as the boring tools, with the exception that they are about 12 inches longer.

The roughing cut is first taken half way through the gun, starting at the muzzle end, after which the gun is reversed in the lathe and the roughing cut is completed from the breech end. The finishing cut is then started from the breech end and taken all the way through the gun. Owing to the close limits specified on the diameter, the wear on the finishing cutters must be extremely small, and therefore a slow cutting speed is used. This speed is not over 10 feet per minute, while the depth of cut taken by each tool of the finishing reamer is about 0.05 inch. The feed is approximately 0.10 inch per revolution.

Cutting the Rifling Grooves

The cutting of the rifling grooves in the liner is a long operation and one that must be carefully performed. Heavy cuts cannot be taken, and a great many passes of the tools must be made to complete the operation. The practice is to machine one-half the number of grooves at a time by employing the "White" type of rifling head illustrated in Fig. 7. There are ninety-six rifling grooves, 0.14 inch deep, in a 16-inch gun, and three sets of cutters are used in rifling this size gun.

The first set of cutters finishes the top of the lands and cuts the grooves to a depth of about 0.03

inch. The shape of these cutters is such that they cut a slightly wider path at each pass, so as to guard against producing burrs that would score the head. The cutters in the second set are shaped somewhat like parting tools, and are used for finishing the bottom of the grooves to the prescribed size and contour.

The cutters in the third or finishing set conform in shape to the complete contour of the grooves, but they do not machine the top of the lands. A feed of 0.0015 inch per cut is used for the first and second cutters, and 0.003 inch per cut for the third cutters, except when they are within a few thousandths of an inch of the full depth, at which time the feed is reduced to 0.0005 inch to insure a smooth finish. The cutting speed is approximately 7 feet per minute, and the return speed about 14 feet per minute, which means that each complete pass of the rifling head through the entire length of a 16-inch gun consumes about 10 1/2 minutes. The actual time involved in rifling a 16-inch gun is approximately 190 hours.

As may be seen from Fig. 7, the cutters of the rifling heads are carried in grooves spaced around the front end of the head. The cutters may be expanded or contracted in the grooves to regulate the depth of cut, by means of a conical sleeve mounted on a shaft at the center of the tool-head. Radial adjustment of the cutters is effected by means of a nut which is easily accessible through the slot in the tool-head. The cutters are automatically collapsed at each end of the forward movement of the tool-head, so as to facilitate the withdrawal of the head, which is accomplished at twice the advancing feed. Before each forward movement, the cutters are carefully examined and expanded the proper amount. After half the grooves have been completed, the head is indexed for machining the other half.

Several following rings are provided to prevent sagging of the bar as it advances into the bore. Lubricant composed of one part of animal or pure lard oil and two parts of kerosene is supplied copiously to each cutter through individual vents.

In the rifling process, the cutter-heads must be revolved as they are advanced, so as to give the proper helix to the grooves and lands, as may be observed from Fig. 10, which shows the rifling in a 155-millimeter (6.1023-inch) trench mortar. The tool-heads, in cutting the rifling grooves of a 16-inch gun, are revolved once for each forward movement of 40 feet. For cutting rifling grooves of standardized guns, rifling bars are employed of the type shown in Fig. 8, which have guiding grooves generated on them at the same helix angle as the rifling grooves to be produced. A plunger mounted on the front bearing of the rifling bar engages one of these grooves and causes the rifling bar to turn in the proper ratio as it is fed forward.

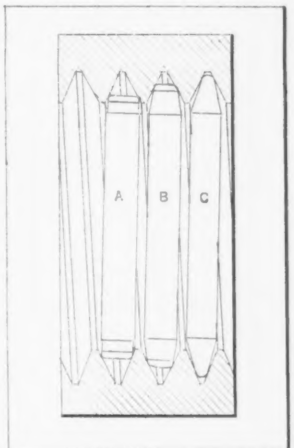
Guns that are of a more or less experimental design are rifled by means of the equipment seen on the table at the right of the machine illustrated in Fig. 9. There is a long flexible steel bar or ribbon, which may be set to any desired curve by adjusting set-screws positioned on both sides. In engagement with this flexible bar are two rollers fastened to a rack which engages a gear mounted on the rear end of the rifling bar. As the rollers follow the flexible bar, they cause the rack to move to the right or left, thus revolving the gear and the rifling bar with it to suit the helix angle of the grooves. This flexible bar is also employed in cutting the grooves in the rifling bars.

* * *

GAGE WIRES FOR INTERNAL THREADS

By WILLIAM S. ROWELL

The making of a threaded plug gage for use in originating or duplicating an internal thread in a few parts increases the cost of such work considerably; but it has been done many times, because there seemed to be no other method of insuring the required accuracy. For work of this kind, the writer has often used wire gages, such as shown in the accompanying illustration. The method of using these gages will be made clear by the following example.



Method of Gaging Thread with Wires

It was necessary to cut internal threads in two bronze bushings required for replacement purposes. The threads were of 10 pitch U. S. form, with an outside diameter of 2 1/8 inches. The bushings were exactly alike, except that the thread in one was left-hand and that in the other right-hand. The improvised gages shown in the illustration, which were used in cutting the duplicate threads, were made from 1/8-inch wire. The wires were chucked and filed to the lengths and shapes shown.

It will be noted that the wire *A* makes contact with the thread near the inside diameter, the wire *B* near the pitch diameter, and the wire *C* at a point near the outside diameter of the thread groove. Only one set of wires was required for gaging both right- and left-hand threads, whereas two gages of the plug type would have been needed. An accurately ground 60-degree tool was used in cutting the new threads. As the final size was approached, about one turn of the thread was finished in advance, using the wire gages after each trial cut.

* * *

NEW CORROSION-RESISTING PROCESS

A new multiple plating process which is said to give unusual protection against corrosion is mentioned in an article in *Der Motorwagen* by Dr. Rudolf Carl. It has been developed by the Langbein-Pfanhauser Works in Leipzig, Germany. The articles to be protected are first given a thin layer of nickel in the electrolytic bath. This is followed by a layer of cadmium, which, in turn, is followed by a heavier layer of nickel, and if desired, a layer of chromium can be applied on top of this. The rust protection of this plating process is said to be much greater than that of a layer of nickel on top of a layer of copper or brass.

What MACHINERY'S Readers Think

Brief Contributions of General Interest in the Mechanical Field

THE FOREMAN AS A PSYCHOLOGIST

The article on page 945 of August MACHINERY shows that there is something in psychology, after all, in the handling of men. When a new machine is purchased, it is taken for granted that the foreman should study its advantages as well as its limitations, in order to obtain the maximum benefit from it for the company. Isn't it just as reasonable to apply the same study to a new man?

There is an old saying that you find in people what you look for, and it has never been more accurately demonstrated than in the machine shop today. If the foreman believes that it is his job continually to find fault, he invariably finds reasons for finding fault, but the foreman who instills confidence in each man and makes him feel that he is working with him and not for him gets the best production. KARL NIXON

FALSE ECONOMY IN THE DRAFTING-ROOM

The condition pointed out by R. H. Kasper on page 20 of September MACHINERY unfortunately is not nearly so unusual as might at first be thought. The primary fault lies in the idea that the products of the drafting-room are drawings. They are not. Drawings are only a preliminary stage in production. The alert shop foreman should return some of these small-scale, small-dimension-figured drawings or blueprints, after they have been in use in the shop for a time, to the drafting-room with appropriate comment.

Prints get very soiled in the shop with grease, oil and dirt. The draftsman, brought face to face with actual production conditions, will soon realize the error of his viewpoint as to convenience, filing, paper costs, etc., when he sees the greater shop problem involved. JOHN F. HARDECKER

STANDARDIZATION OF QUALITY

The editorial comment on page 18 of September MACHINERY represents the current view of the limitations of standardization. To confine standardization to dimensional interchangeability is proper in the majority of cases, but a word of caution should be given for the exceptional case.

Conforming to a specific engineering society's standard is often recognized as a guarantee of merit for any product so designated. With purely dimensional standards, there is always a possibility that an unscrupulous manufacturer may fabricate an inferior material, with the hope of underbidding competitors.

The aeronautical industry, wherein strength is a prime factor, has this situation to face. To standardize on purely dimensional standards appeared dangerous, particularly if replacement parts, similar in dimension but different in strength, due to steel or heat-treatment variations, were mixed up at a service field. To limit the material for any given standard was regarded as too restrictive, yet the situation had to be met. Physical requirements, in the form of minimum strength, became a part of the specification. In addition to dimensional interchangeability, strengths also were standardized to a minimum value. Manufacturers of aeronautical standards were permitted freedom of choice, provided their material as fabricated could meet both dimensional tolerances and physical tests. JOHN S. MORAN

FURNISHING TOOLS TO WORKMEN

The article on furnishing tools to workmen in August MACHINERY should meet with the approval of all executives. It imposes a hardship on the mechanic to buy all the expensive tools used and needed to do first-class work in the modern machine shop. I believe that a machinist should own only the smaller and less expensive tools of the trade, such as small hammers, combination and try squares, scales, center gage, thread gage, center punch, monkey wrench, a couple of small pliers, inside and outside spring calipers, a pair of dividers, surface gage, a set of feelers, and a one-inch micrometer.

Anyone engaged in machine shop practice knows a good set of tools is absolutely essential to first-class work. At our plant we furnish all measuring instruments and keep them in first-class condition, which eliminates any excuse on the part of the men for turning out poor work for lack of proper tools.
WILLIAM C. BETZ

STANDARD MACHINE TOOL DIMENSION SHEET IS AVAILABLE

In September MACHINERY, page 23, the need of data sheets that would give the necessary dimensions of machines for which tools or fixtures have to be designed, was pointed out. Some time ago the National Machine Tool Builders' Association adopted a standard sheet which is used by many of its members at the present time. This sheet gives not only the dimensions that are needed by the tool designer but also full information regarding spindle speeds, feeds, floor space required, capacity, and motor size. In addition, there are spaces for the maker's serial and user's shop numbers as well as a great deal of other data relevant to the machines. Being of uniform size, these sheets can be bound in a folder and kept on file in the drafting department where any one seeking data can obtain it without having to measure the machine or interfere with production in any way.

It would be a good thing for the industry if all builders would adopt this handy standard, for thus much of the time now used in writing for informa-

tion would be saved. Any type of machine can be covered by this sheet. To those firms now using this system, the writer suggests that sheets be mailed at the time of sale to the chief tool designer, department foreman, and machine erection superintendent of the companies purchasing their product. This will acquaint a great many persons with the existence of these sheets, and will place all the dimensions of the machine in the hands of those most interested. H. C. KLINE

A QUESTION OF BUSINESS ETHICS

In commenting upon "Observer's" article on page 902 of August MACHINERY, I feel that if, after the customer was informed at the time of purchasing the machine, and again over the telephone, that he was to use a light oil in the speed-box with gears, and the service man was sent a distance of 400 miles to investigate and found that a heavy grease was being used, the customer should pay all costs, and the machine builder should insist on such payment to uphold his reputation as a builder, for there really was nothing the matter with the design of his machine. If the customer persists in not paying for the service rendered, the machine builder has grounds for a law suit, as had the builder in another case I have in mind; but this builder, rather than make unfriendly feelings among his customers, played a real sportsman's part and met the customer half way by paying half the expense of supplying the service man and paying his wages besides. MORTON SCHWAM

WHEN A SALESMAN WAITS, WHO PAYS?

The writer believes that many buyers not only waste a salesman's time by keeping him waiting unnecessarily, but also force the seller to incur unnecessary traveling expenses, all of which add to the cost of selling and to the price of goods. It is sometimes inconvenient to take time to interview salesmen, and the tendency is to let them wait. But it adds to the cost of selling whether our salesmen or the other fellow's is obliged to waste his time. This attitude toward the man who sells seems to be due to the idea that the buyer is conferring a favor in making a purchase. In reality, the only reason we buy is because we have use for the goods. Hence there should be no more feeling of favor on one side than on the other. The cost of sales is too high in many industries, and the buyer is at least partially responsible. If buyers will study their side of the transaction with a view to eliminating unnecessary costs and unfair demands, a step will have been taken in the right direction. R. D. GUNNIS

BUYING THE RIGHT MACHINE

The buyer of new equipment ought to determine exactly what a machine is to do before he purchases it. On first thought, it appears obvious that the buyer would know what he intends to use the machine for; otherwise he would not be in the market. The facts are, however, that except in quantity production shops, where a machine is bought for one specific job, the user does not generally have a definite idea of the specific work the machine is to do. It requires an investigation and analysis of the work in the shop to specify what particular work will be assigned to this machine, and what its construction and adjustments ought to be to make it best suited to that work.

In the majority of cases, new machines are either additions to existing equipment or are provided for new plants to continue a business already established. Usually, therefore, the purchaser has sufficient operating data available, so that if proper thought is given to the matter, he can determine definitely what the new machine is to do, and thereby be guided in buying a machine exactly suited to his needs. B. SLADEN

HOW MECHANICAL ARTICLES SERVE THE JOBBING SHOP

Many men are of the opinion that articles on production methods are not applicable to the jobbing shop. The writer believes that this idea is incorrect and that articles on production can be studied to considerable advantage by men in smaller shops.

Four necessary elements in getting work done in any shop are the purpose of the work, the material, the tools, and the man. The obstacles encountered in the jobbing shop are practically the same as those in any quantity-production shop. As there are the same elements of production and the same obstacles in common, the jobbing shop should be able to apply at least partially, the ideas given in articles on mass production.

I have often heard executives in jobbing shops say that a certain article or advertisement did not concern them because it pertained to the automobile shops, or some other quantity production industry. This idea seems erroneous to me. I believe that many men pass up these articles too readily without realizing that, although conditions do not permit their being applied in their entirety, nevertheless, one-third, or even one-half of the ideas may be applicable to their work. THOMAS E. KELLY

CANCELLATIONS INVOLVE AN OBLIGATION

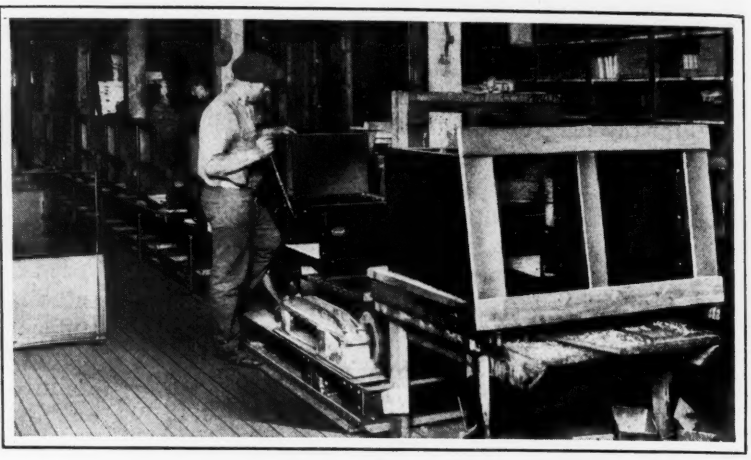
While unexpected conditions may warrant a dealer or manufacturer in holding up or cancelling an order, there is no justification for the position taken by many buyers that they may cancel or reduce orders once given without incurring any obligation. If manufacturers of machine shop equipment permit buyers to escape responsibility for losses involved in cancellations, they encourage over-purchases and careless ordering, with the loss and derangement of business that such purchases and consequent cancellations bring about.

If the dealer, jobber, or shop equipment using manufacturer realizes his responsibility when he places an order, he will more thoroughly investigate conditions before he buys, and base his order on carefully determined facts.

The idea that orders may be cancelled at will can be cured only by vigorous insistence on responsibility for the losses involved. This is essential to the continued soundness of the business structure.

HARRY KAUFMAN

Conveyor for Progressive Assembly



By J. C. MERWIN, Vice-president,
Chain Belt Co., Milwaukee, Wis.

A SUCCESSFUL application of progressive assembly has been made by the Cribben & Sexton Co., of Chicago, manufacturers of stoves and furnaces. By the use of a conveyor in assembling gas ranges, this company has not only made a substantial reduction in direct labor and trucking costs, but has also increased production from 80 to 210 ranges per day, with one-half the floor space formerly used.

Gas ranges are made in a great variety of sizes and styles. The complete line of Cribben & Sexton ranges covers over seventy varieties. This diversification of models was the greatest obstacle to be overcome in planning the assembly operations. However, careful analysis of the corresponding operations on the various sizes and styles showed them to be quite uniform. By subdividing all assembly operations into equally timed groups, practically every type of gas range was adapted to conveyor assembly. These balanced operations, carefully worked out, resulted in much saving of direct labor.

Formerly, each skeleton frame of a range had been mounted on a pair of "horses," and two men did all the assembly operations on it. This had many obvious disadvantages. The assembly operations covered considerable floor space, and eighty ranges per nine-hour day was the maximum capacity. Much trucking was necessary to distribute parts and take away finished ranges. As a result, the department always appeared congested. Piecework labor rates required men skilled in every assembling operation on the full line of ranges, and the training of new men took a long time. With this method, it was difficult to increase production.

The new method of conveyor assembling, using "Rex" conveyors, is shown in the illustrations. The conveyor is 196 feet long, and carries the ranges 20 inches above the floor. The ranges are carried along at from 1 to 2 feet a minute, depending on the output desired and the number of men working on the line. At full capacity, thirty men are working, and the output is 210 stoves per nine-hour day. At the beginning of the conveyor (shown in the heading illustration) skeleton frames are assembled at a bench and bolted to crate bottoms that have been previously drilled. They are then placed on the conveyor and the oven front, burner boxes, splashers, and top guards are put in place and fastened. With the exception of the skeleton frame and the manifold assembly, all mounting operations are done on the conveyor while the stove is moving.

The man in the foreground of Fig. 1 is putting the stove manifolds in place. The door panels and door linings are put in place by the next man. The oven doors are then fitted. This operation involves some grinding and fitting on an emery wheel at the bench.

The next operation, shown in Fig. 2, consists of placing the oven linings in position. On one size of range it is necessary to place the oven lining from underneath, and this is being done by the man at the right of the illustration. This operation necessitates an unusual construction of the conveyor. The ranges are supported on maple strips, 27 inches apart, so that the range is accessible from underneath the conveyor. Except for supports 3 inches wide at five-foot intervals, there is no obstruction from the conveyor frame. The stock racks for oven linings are directly behind the man, and other parts are shown in the racks above.

The final operations of inspecting, testing, painting nickel parts for protection, and packing burner trays, legs, and loose parts are shown in Fig. 3. The range is now ready for crating, and when discharged at the head end of the conveyor is trucked to the crating department. Here another saving has been made, for the completed ranges are all discharged at one point and the necessity of collect-

Fig. 1. Assembling Stove Manifolds and Door Panels

Fig. 2. Conveyor Construction Permits Oven Linings to be Inserted from Underneath

ing them from all parts of a large assembly department has been eliminated.

The advantages secured by the new method may be summarized as follows: (1) Floor space used is one-half that required by former methods. (2) Maximum production has been increased from 80 to 210 ranges per nine-hour day. (3) Trucking of parts and finished ranges has been almost cut in half. (4) Direct labor cost has been reduced 20 per cent. (5) A congested department has been changed to a very orderly one. (6) A definite production pace is established, and may be increased when necessary. (7) An inexperienced man may be quickly taught his particular operation, and poor work with resulting complaints is greatly reduced. (9) A gang piece price is used, and is found much more satisfactory than the former individual piece-work rates.

* * *

MARKING BAR STOCK FOR IDENTIFICATION

At the Machine Shop Division meeting of the American Society of Mechanical Engineers at Cincinnati, Ohio, September 24, Hugh W. Roughley, quality manager of the Wright Aeronautical Corporation, read a paper on inspection methods and quality control in the manufacture of airplane engines, in which he outlined the different inspection methods used in the building of Wright airplane engines.

In this connection, he mentioned that all bar stock received by the company, after having been carefully inspected, is stamped—each bar individually—with the specification number and lot number on each end, in order to positively identify the material. An exact record is entered in the metallurgical log book, giving specification number, lot number, heat number, amount of material received, amount of material accepted, amount of material rejected, and name of vendor.

In addition to being stamped with the specification number and lot number, each bar is painted its entire length with the color combination designated for its particular material specification. This furnishes a convenient method of identification in the stock room and through the manufacturing departments, so that the identification of material that is not up to requirements is possible at any stage of production, from raw material to finished product. For instance, twenty-three different grades of steel are purchased for various parts of Wright engines—tough steel of a low carbon content to be casehardened for piston-pins, knuckle pins, and gears; high-speed tool steels, tungsten and cobalt chrome for exhaust valves and guides; high-carbon chrome nickel and high-carbon vanadium steels for highly stressed parts such as connecting-rods, studs, bolts and nuts; carbon steel for washers, keys, pipe flanges, etc.—most of which is received in long bars of identical appearance. Positive identification, therefore, is very important.

* * *

POLISHING IN A HONING MACHINE

By W. E. WARNER

Journals of automobile crankshafts of a number of makes are now finished by honing, using abrasive stones carried in a holder called a hone. This gives the crankshaft a fine finish. The same machine and holder can also be adapted for polishing, which gives a finer finish. In this case, the abrasive stones should be replaced by sticks made of ground cork impregnated with a soft cutting material. The polishing operation is just the same as honing, except that the speeds used may be 50 per cent higher.

The polishing sticks can be made of finely ground cork impregnated with a paste of tripoli powder, water, and a sizing for binding. With a little care, the sticks can be molded to the desired form, and when dry, will be sufficiently strong for polishing.

Polishing is not suitable for correcting errors. The best results are secured by first honing with stones, and then finishing by polishing. The finer finish will be obtained at no greater cost. No lubricant should be used when polishing.

Fig. 3. Conveyor Delivers Ranges at One Point, Ready for Crating

When and Where to Use Grease as a Lubricant

By H. L. KAUFFMAN, Consulting Petroleum Chemist and Lubricating Engineer, Denver, Colo.

VARIOUS classes of greases adapted for lubrication purposes were described in a previous article in October MACHINERY, page 92. The conditions under which the different greases should be used were also dealt with. In the present article, the advantages and disadvantages of grease as a lubricant will be considered.

The outstanding advantages of grease lubrication for conditions either where the use of oil is not entirely suitable or where it is doubtful whether grease or oil would be more satisfactory, are as follows:

1. Makes possible lubrication of bearings where pressure is too great for successful oil lubrication.

2. Prevents waste of lubricants from poorly housed bearings. The use of grease, therefore, is more economical than oil, and from the standpoint of cleanliness, it insures better working conditions.

3. Reduces cost of lubrication in many cases by reducing the labor required for applying the lubricant, as well as the amount of lubricant fed to the bearings.

4. Makes possible lubrication of inaccessible parts of machines.

5. Can be made exactly to fit lubricating conditions, since grease is a manufactured product, whereas oil always remains fluid.

6. Reduces wear on the bearing, due to the fact that the admission and accumulation of grit is reduced to a minimum in grease-lubricated bearings. Because of its solid nature grease forms a ring of solid lubricant around the edges of the bearing, automatically sealing these points. In other words, the lubricant itself blocks the lubricating opening. Further, as grease is fed gradually to a bearing there is exerted a powerful washing action which tends to wash out and eliminate any particles of foreign matter that may have gained admission.

7. Prevents the splashing and dripping common when oil is used as a lubricant. Grease lubrication, therefore, makes possible greater cleanliness around the bearings and other wearing parts.

Theoretically, grease lubrication is best suited to low-speed service. Normally, at low operating speeds, a grease film is thicker than an oil film, due to the heavier body of the grease. Hence the rate of distortion in a grease film is less than that of an oil film. However, machinery details and the relative adaptability of each lubricant for the service intended are the first important factors to be considered when determining the advisability of using grease or oil as a lubricant. Still, it should be mentioned that in the lubrication of many machines, because of machinery details, grease alone is adaptable for use.

Disadvantages of Grease as a Lubricant

The main disadvantage of grease as a lubricant lies in the fact that grease possesses a higher coefficient of internal friction than oil, and therefore offers greater resistance to motion when a bearing or shaft starts moving. More power is necessary at the start to overcome this tendency to resist motion with a grease than with an oil. Hence, it can readily be inferred that since the use of grease is advantageous in the lubrication of slow-speed, high-pressure equipment, wherein a relatively thick film of lubricant is desirable, greases will be disadvantageous under high-speed conditions.

Another so-called disadvantage of grease lubrication is the lack of uniformity in the character of greases as made by different manufacturers. Greases as marketed by different companies differ widely in regard to consistency specifications. Consistometers are now being used to help the grease-maker to produce uniform batches of grease at all times, but different grease-makers do not agree on what the consistency of any given grade of grease should be. Since many greases are marketed under merely a numerical designation by the present system, it is possible that a No. 3 cup grease made in St. Louis may be so different from a similarly designated grease made in Kansas City that for a condition of lubrication for which one might be particularly adaptable, the other might cause serious lubricating difficulties. However, oil companies at present are working together more and more toward adopting definite standards for consistencies on various grades of grease.

Properties Grease Should Possess

To obtain the most successful and satisfactory results from the use of grease as a lubricant, the grease should possess the following properties:

1. It must have great adhesiveness, so that it will cling tenaciously to the bearing surface. In other words, it must "stay put." Otherwise, it loses its principal advantage as a more practical lubricant than oil for many conditions of lubrication.

2. It should have such a melting point that at the temperatures and pressures at which the grease is to be used, it will function most satisfactorily. Its melting point must be definitely adapted to the conditions of operation. If too low, the grease will melt and run off the bearing, thus proving to be little more useful than an oil. If the melting point is too high, the grease will not spread itself effectively over the bearing surface.

3. It should be of such consistency that it will be definitely adapted to operating conditions. It must not waste more than a minimum of power. The lower the consistency of a grease, the lower is the power loss—other things being equal. However, if the grease is of too low consistency, it may not cling properly to the surfaces to be lubricated. Hence, for each condition of grease lubrication, there is a grease made of such consistency that power losses will be kept at a minimum, and at the

same time, the lubricant will adhere firmly to the rubbing surfaces.

4. It should retain, as nearly as possible, its original physical properties, both while in storage and in use. Exceptions to this are some special greases which are so made that their consistency will break down in use, this characteristic permitting the ready application of the grease and making possible the proper lubrication of the rubbing surfaces thereafter. Soap-containing greases, however, are subject to chemical changes upon exposure both to high temperatures and to the oxidizing action of air. Most of them, also, show a tendency toward the separation of the oil and soap constituents. In general, however, a grease should be as free as possible from the tendency either to decompose, to oxidize, or to turn rancid upon exposure to the air.

5. It should have sufficient consistency to insure a film of lubricant between the bearing surfaces under the maximum pressure at which the grease might be required to lubricate. This is equivalent to saying that the grease should be of a consistency that is suitable to the operating conditions under which it must function. Opinions differ as to whether or not greases actually are capable of withstanding greater bearing pressure than oils. The idea that greases can carry greater bearing pressures than oils seems to have its only basis in the fact that greases ordinarily have greater consistency, that is, greater viscosity, than oils. However, because there are conditions of lubrication for which lubricants that are able to withstand great pressures are required, this property of greases is mentioned here as being desirable.

6. It should be absolutely homogeneous. It should contain no impurities or lumpy matter that might interfere with proper application; that is, there should be nothing in the grease that might cause clogging of the lubricator, of grease cups, or of oil ducts.

7. It should be free from so-called non-lubricating "fillers," such as asbestos, talc, soapstone or chalk—such ingredients being incorporated in some greases mainly for the purpose of giving greater viscosity, or body, to the lubricant. Frequently, such fillers contain gritty substances which abrade the bearing surfaces. The grease likewise should be free from excessive quantities of either acids or alkalies, as such substances (when present in appreciably large quantities) corrode the bearing surfaces. In general, grease lubricants cannot be tested as readily for the presence of injurious or useless ingredients as oil lubricants.

8. It should not have a rubbery appearance, unless some special operating condition demands the use of a grease of such characteristics. Usually, a rubbery appearance is indicative of the fact that not enough water is present in the grease and, as a result, such greases are likely to show a more rapid separation of mineral oil.

In conclusion, then, it is to be noted that greases are not suitable for use under all conditions of lubrication, and their use should be decided upon only after a careful study of the adaptability of the lubricant for the particular condition of lubrication under which it must function. Grease and oil each have fairly definite limits as to where and where not their use will be most satisfactory. However, when it is deemed either advisable or necessary to employ grease lubrication, due consideration should be given to the properties of greases and the advantages and disadvantages of their use before deciding upon the grade of grease that will be best adapted to the work.

* * *

STANDARDIZATION IN INDUSTRY

Possibly the outstanding feature of the American industrial system is standardization. Its success in this country has led to its extension in Europe, even to industries such as coal which have been in existence long before the United States became a nation. Operating originally for the purpose of eliminating waste, standardization has had important social reactions upon the worker, the consumer, and those who are managing industry's affairs. Where common standards are assumed, cooperation becomes a natural corollary.

In the years immediately preceding the war, variety was a prevailing characteristic in merchandising. The distinction had not been clearly emphasized that there was a group of products where style and originality were of primary importance, and another group of products where relatively few types would give the most satisfactory performance. The war, with its emphasis upon efficiency, immediately revealed the necessity for some process of simplification, and one of the duties of the War Industries Board was to eliminate the production of an unnecessary variety of sizes and types of stock products. The Government strictly enforced a variety limitation in all those commodities which could be regarded as essential products. The reductions effected by the Department of Commerce are given in the following:

Commodities Used	Average Per Cent Reduction in Types
Mill supplies, shop equipment, etc.	59
Construction materials	71
Building materials, equipment, fittings, etc.	72.5
General supplies and furnishings for homes, hotels, hospitals, clubs, etc.	76.5
Plumbing	89
Business documents	99.44

The astonishing percentage of simplification in the item "Business Documents" is explained by the fact that whereas such things as warehouse receipts, invoices, purchase orders, bank checks, and deposit slips have all been made in a thousand different forms, now there is one Standard Form for each of the documents.—*"The Index," published by the New York Trust Co.*

* * *

According to information published in *Engineering*, the production of agricultural machinery in the Soviet Union exceeds the pre-war output by about 35 per cent. Schedules for the coming year contemplate an output of nearly double the 1913 volume. Cream separators, which have not been produced until recently, are now made at the rate of 60,000 a year.

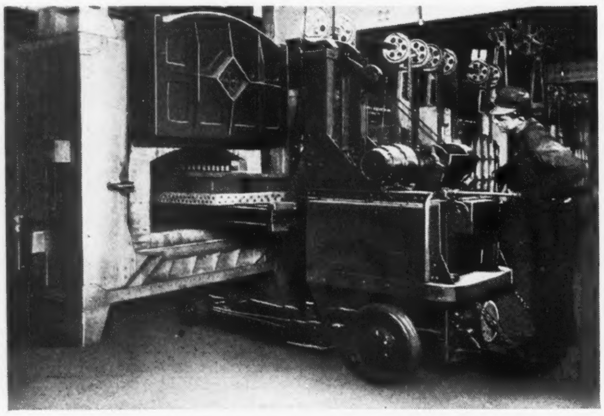


Fig. 1. Charging a Furnace by the Use of an Electric Lift Truck

SOME OF THE METHODS USED IN BUILDING WHITE MOTOR TRUCKS

In charging furnaces at the White Motor Co.'s plant in Cleveland, Ohio, the use of an electric lift truck, as shown in Fig. 1, reduces the labor required and conserves the heat of the furnace, because it is possible by the use of this equipment to load and unload the containers rapidly. The doors of the furnace are operated pneumatically, and the entire operation can be easily controlled by one man.

The furnace shown in the illustration is of the electric box type, the heat being controlled by a pyrometer. The average temperature maintained during the carburizing process is 1700 degrees F. for a period of from ten to twenty-five hours, depending upon the class of material being treated.

Fig. 2 shows a taper hole in a wheel hub being ground. By the process of internal grinding an accurate fit is assured between the wheel hub and the axle taper. When holes are taper-reamed, difficulties are sometimes experienced because the bearing is on a few high points. In service, the ground hub has no tendency to become loose, because it is practically integral with the axle.

Fig. 3 shows the balancing of pistons. The pistons are balanced to an accuracy of plus or minus 1/8 ounce by removing stock from the inside of the open or skirt end. To the right in the illustration is shown a balancing scale used for weighing each piston. To speed up the operation, a lever-chuck is used which makes it possible to load and unload without stopping the machine.

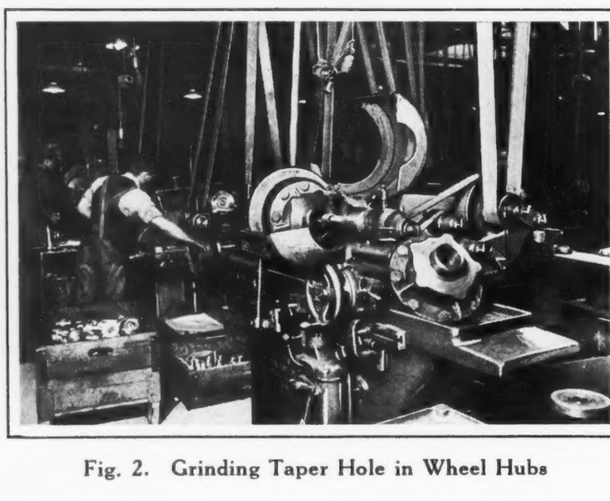


Fig. 2. Grinding Taper Hole in Wheel Hubs

STANDARDIZATION OF LEATHER BELTING

A proposal was recently made by the American Society of Mechanical Engineers to establish definite standards of leather belting to guide industrial purchases, which amount annually to about $30,000,000. The proposal is now being considered by the executive committee of the American Engineering Standards Committee. If approved, the work will be undertaken shortly, covering: (1) Quality (standard material specification); (2) capacity (horsepower rating); (3) weight (dimensions, thickness, and weight); and (4) care and maintenance.

Precedent for belting standardization is found in the work of the American Petroleum Institute, which has established standards for all types of belting used in the oil industry. The Institute estimates that its specifications and recommendations for care and usage increase the service value of belting by 25 per cent. A like saving to all industries in the United States would amount to more than $7,000,000 annually.

If the proposal is approved, a sectional committee will be formed immediately, which will investigate the results of the research work conducted by various organizations. It is pointed out that, aside from the direct money saving involved, these studies would lead to a great increase in the present knowledge of the properties of leather belting.

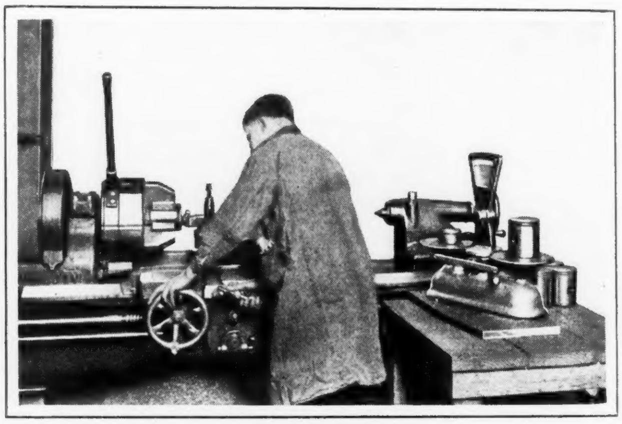


Fig. 3. Balancing Pistons for White Motor Trucks

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DIESEL ENGINES FOR AIRPLANES

The successful test flights recently made by a Stinson-Detroit monoplane equipped with a Diesel engine developed by the Packard Motor Car Co., Detroit, Mich., have attracted much attention. This engine is of the radial air-cooled type and has a rating of 200 horsepower. With the use of oil for fuel, gasoline ignition systems, spark plugs, and carburetors are eliminated, and the danger of fire from gasoline is removed. Lessened fuel consumption and cost are other advantages, it being said that the engine will carry a plane 25 per cent farther with the same weight in oil fuel as compared with gasoline. Radio communication with aircraft will be possible on a broad scale, it is stated, because the interference that exists at present due to the electrical ignition systems on gasoline engines can be eliminated.

Grinding Fixtures for Shell-boring Tools

By JIM HENDERSON

SUCCESS in machining steel forgings depends as much upon efficient tool maintenance as upon the machining methods employed. Probably few tools need more careful consideration than boring cutters, with respect to maintenance methods. The making of ammunition for high-powered artillery, for instance, requires the exercise of great care in keeping the boring cutters in condition, in order to insure smooth bores in the steel shells. The action of a shell in flight is such that a disastrous premature explosion may result from roughness or irregularity in the bore. Even the slightest scratch may create sufficient friction to ignite the explosive charge. Such an occurrence must be guarded against by every means in the power of those responsible for the safety of the men who operate the guns.

The revolving motion imparted to the shell by the rifling in the bore of the gun is produced instantaneously and cannot be immediately transferred to the inner explosive charge. Although both the shell and its contents rotate in the same direction, the rotational velocity of the shell is much greater than that of the explosive as the shell begins its flight. Until the rotational velocity of both the shell and its explosive charge becomes uniform, there is always the possibility that friction will ignite the charge and cause a premature explosion.

Many fixtures and devices have been designed in an effort to provide means for maintaining maximum efficiency of boring-bars and cutters. The accompanying illustrations show two boring cutter grinding attachments originally developed for use in shell production, but which have now been adapted to general boring work. One of these grinding fixtures, shown in Fig. 1, is mounted on the table of an old planer.

The main casting *A*, which supports the boring arbor, is pivoted on the pin *B* in the table of the planer. The arbor *D* is held in position by the cap *C*, and is inclined at an angle of about 6 degrees with the axis of the grinding spindle. The angular location serves to produce a clearance on the cutting edge of the boring cutter which varies from about 7 degrees clearance at the nose of the cutter to a nil clearance at the extreme base. This method of grinding not only provides an ideal cutting edge where the bulk of the cutting is done, but also furnishes a non-cutting support and guide for the rear section of the cutter.

One of the difficulties previously experienced in boring steel shells was the tendency of the cutter to gouge out a recess at the base of the blade. This recess could seldom be seen with the naked eye, but was easily detected by the inspector when suitable gages were employed. The non-cutting support referred to served to eliminate this trouble.

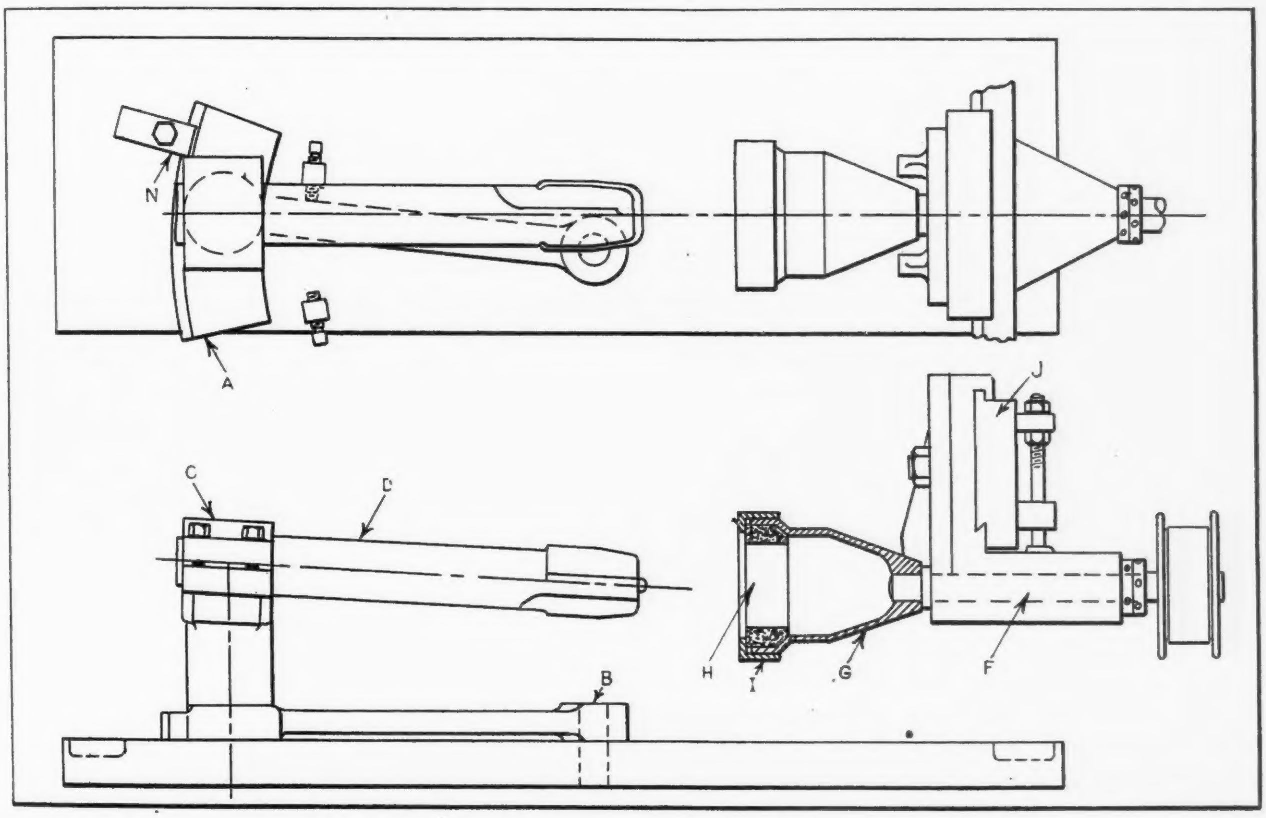

Fig. 1. Fixture for Grinding Straight and Tapered Portions of Boring Cutter

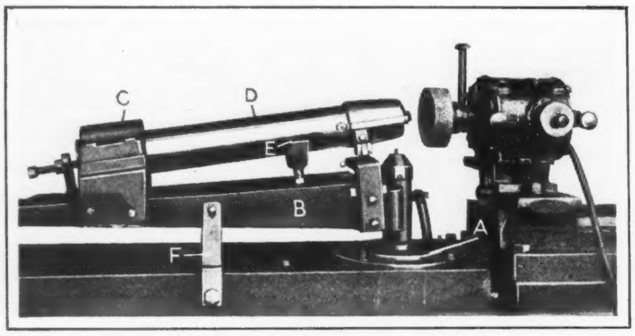

Fig. 2. Set-up for Grinding End and Corner Radius of Boring Cutter

Secured to the cross-rail J of the planer is a special casting which carries the grinding spindle F, to the nose of which is secured the chuck G. The grinding wheel H is held in position by the large nut I. These wheels are made specially for this purpose, the diameter of the hole being such as to give the best results on the type of cutter to be ground. Adjusting nuts at the rear of the grinding spindle serve to take up lost motion at the end of the bearing. Stops are located on the planer table to fix the position of the bar when the parallel edge and the tapered portions are being ground.

When the straight sections are being ground, the fixture is held rigid by means of the clamp N. The position of the pin B is such that when the bar is being moved or pivoted from one fixed grinding position to the other, the radius between the parallel and the tapered section is automatically formed. After the cutters have been ground, any small burrs that have been formed are removed by the slight application of an oilstone. The longitudinal feeding mechanism (not shown) consists of a large handwheel secured to a shaft supported in bearings at the front of the cross-rail supports, and a sprocket and chain drive from this shaft to the feeding rack of the planer table.

A device similar to the one described, which was developed for grinding the face and end radius of the same cutters, is shown in Figs. 2 and 3. The foundation of this device is a long piece of channel iron upon which is secured an ordinary compound rest, the upper portion supporting a small angle bracket to which is bolted the slide that carries the electric grinder. Also secured to the channel iron is the disk casting A, the central pin of which is located directly below the center of the nose radius of the cutter when the latter is in the grinding position. Pivoted on the pin on disk A is the casting B which, by the way, is a discarded trolley base. To the casting B is secured the bracket C for holding the bar D in position. An additional support E, in the shape of an adjustable Y-shaped member, is provided.

A dust-cap is placed over the pin in base A to protect the bearing from the abrasive dust of the grinding wheel. The bar is tipped in two directions, so that when the fixture is swung around, in grinding the radius, the clearance will correspond to that obtained in the preceding grinding operation. Stops like the one shown at F, Fig. 2, determine the exact setting for grinding each of the edges.

THE AUTOMOTIVE PRODUCTION MEETING

The program for the production meeting of the Society of Automotive Engineers, to be held at the Book-Cadillac Hotel, Detroit, Mich., November 22 and 23, has been announced. The papers to be presented promise a meeting of unusual interest. John Younger, of the Ohio State University, will read a paper on "How the Ford Motor Co. Gets its Phenomenally Low Production Costs," and L. A. Baron, comptroller of the Stutz Motor Car Co., will present a paper on "Production from the Accounting Point of View."

H. D. Tanner, of the Pratt & Whitney Co., will read a paper on "The Barnes Gear Shaver Process"; a paper on "Honing Progress" will be presented by C. G. Williams, of the Barnes Drill Co., and one on "Integral Contact Gearing," by A. B. Cox. "How to Decrease Production Costs Ten Per Cent" will be the subject of a paper by W. W. Nichols, of D. P. Brown & Co. Paul Geyser, of the General Motors Truck Co., will discuss the subject "Development of Production Engineers and Executives."

Other papers to be presented before the meeting will deal with the relation of time study to manufacturing, the selection and utilization of machine tools, methods by which the factory management is informed as to the necessity for purchasing new tool equipment, methods of selecting new machines, handling of materials in automobile plants, chain and other types of drives, and actual savings obtained by production engineers in the proper use of belting.

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REMOVING EYELETS OR TUBULAR RIVETS

By HARRY W. RUBINSTEIN

It is very difficult to remove eyelets or tubular rivets from parts which must be disassembled to correct mistakes or to make repairs. It has been our practice to drill out the eyelets, using a rotating drill above, and a stationary drill beneath the eyelet, but this method is slow and somewhat unsatisfactory. Much better results are now obtained by using a spot welder which burns out the eyelet. Two special points, a little larger in diameter than the eyelet heads, are used on the electric welder.

When the eyelet is placed between the points of the welder and the current turned on, the eyelet is burned out, so that it opens in the middle where the smallest cross-sectional area exists. The eyelets can then be easily removed, leaving the rest of the material in good condition for disassembling or reassembling.

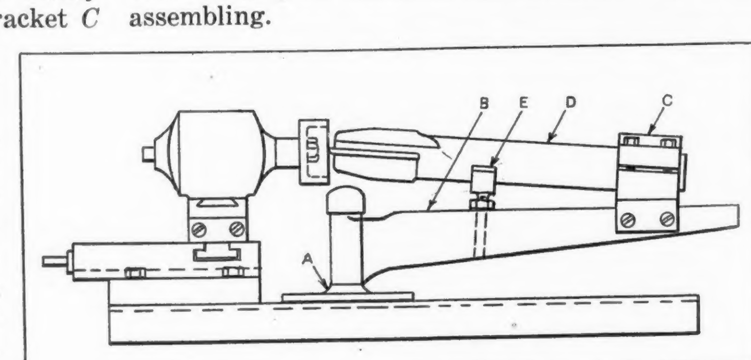


Fig. 3. Side View of Grinding Fixture Shown in Fig. 2

Notes and Comment on Engineering Topics

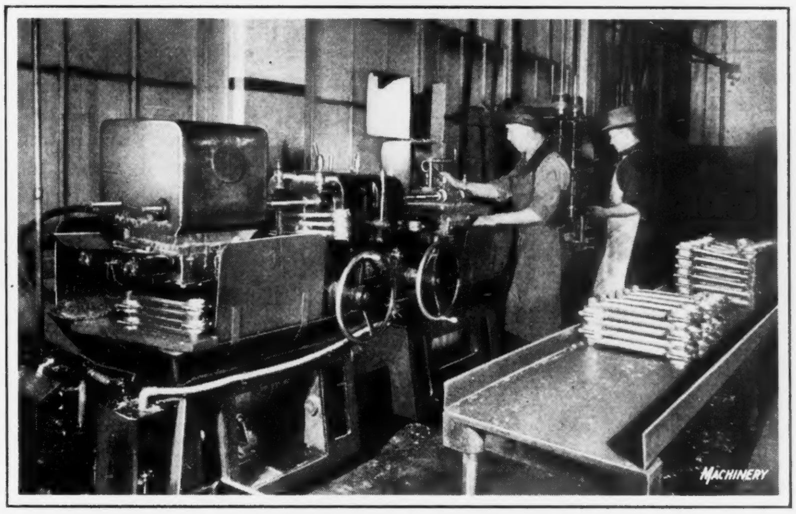
A Swedish law was enacted this year by which the period for which patents are granted has been extended from fifteen to seventeen years. The annual fee for each of the sixteenth and seventeenth years has been fixed at approximately $110. The law applies also to patents in force at the time when the law became effective.

When the new chimney in connection with the proposed smelter additions at the Copper Cliff plant of the International Nickel Co., at Sudbury, Ontario, Canada, is completed, it is estimated that it will be the tallest structure of its kind on the American Continent. The tallest reinforced concrete chimney on the American Continent at present is located at Noranda, Canada, and is 422 feet 6 inches tall; it is 18 feet wide at the top. The total height of the new chimney will be over 440 feet.

An electric distributing station that will ultimately be able to supply power sufficient to light the homes of approximately 300,000 families will be operated without a human being inside its walls. This manless station, one of the largest in the world to be operated without a single attendant, will be controlled from another station more than three miles away. The distant operator can close or open any switch, placing in service the various circuits in the new station simply by pressing keys which send over wires electric impulses of the dot and dash system used in telegraphy. Also, he will receive automatic signals from the station that will inform him whether or not the equipment is functioning properly. This station has just been put into service by the New York Edison Co.

At the Swedish Fair in Gothenburg this year a demonstration of the Mellis method for electrolytic treatment of metal surfaces received much attention. This method finds its main application on iron or steel, but may be used also for coating all other metals, except aluminum. The new method makes use of an electrolytic bath by which a coating is obtained consisting chiefly of superoxide of lead. The process generally requires from one and one-half to three hours of immersion, after which the objects are taken out of the bath in a finished condition. The coating, which is perfectly even, does not oxidize in the air. It may be produced either in black or, by varying the composition of the bath, in a warm red hue which hitherto has not been obtainable directly on iron or steel.

According to James A. Burbank of the John W. Ferguson Co., builders, the modern type of American factory now costs about 23 cents a cubic foot to build, assuming level ground, normal foundation conditions, and average factory equipment. This would provide for a reinforced concrete building with about 12-foot ceiling heights, columns 20 feet apart, and floors designed to sustain a working load of 125 pounds per square foot, cement-finished. Factory-type steel windows would fill about 50 per cent of the wall area. A steam heating plant would be provided, as well as sprinkler equipment, plumbing, elevator equipment, loading platforms and other necessary accessories to the operation of a factory. The statement that such a building can be constructed for about 23 cents a cubic foot is based upon experience in executing 800 contracts for industrial buildings.



Special Diamond Boring Machine Used in the Packard Motor Car Co.'s Plant for Boring Both Ends of the Connecting-rod after the Rod is Babbitted and the Bronze Bushing Pushed in. Diamond Tools Are Used to Insure a Straight Round Hole and to Reduce Rejections in Inspection

Electromagnetic induction has been made the basis of a method of prospecting for ore deposits. An alternating current is caused to flow in an "energizer" on the surface of the ground, similar to a small radio transmitter with a coil antenna. This current creates an electro-magnetic field which causes currents to flow by induction in conductors underground. Many metal ores are better conductors than other rocks and earths. The quantity and character of the current induced are markedly affected, therefore, by the presence of an ore body, and depend upon the type of ore, the frequency of the current in the energizer, the relative conductivity of the substances at and below the surface of the ground, and the current distribution. The ore is located by a direction finder not unlike that used on shore radio stations for locating the position of ships at sea.

Current Editorial Comment

In the Machine-building and Kindred Industries

OVERCAPACITY IN THE MACHINERY INDUSTRIES

At present our machine shops are well employed, but there is usually enough equipment either standing idle or employed only part of the time, to make possible a considerable increase in output, if there were a demand for it. Apparently the shops of this country have a production capacity that exceeds the normal demand by quite an appreciable percentage.

But keen observers of industrial conditions, including Mr. Hoover, have pointed out that this overcapacity is more apparent than real. When the increasing demand, as in the automotive industry, reaches the present level, practically all the modern and up-to-date equipment available in the shops is forced into use. The partially employed and the idle equipment is of old and often obsolete design, and cannot be used to advantage under normal conditions. It is only when some strong demand reduces the strain of competition that this "uneconomical" equipment can be used profitably. Therefore, instead of an overcapacity existing in the machinery industries, they appear to be provided with a large percentage of emergency equipment of older design and construction that cannot be operated economically under normal conditions.

* * *

BUILDING FROM WITHIN

Recently the chief executive of one of our largest manufacturing establishments stated that it is possible to train within an organization a sufficient number of men so that virtually all positions in the sales, office and shop departments can be filled without hiring men from the outside. The system of training, beginning with the apprenticeship, can be made so complete that all the skilled labor in a large organization may be provided from those employed in the plant. In proof of this statement, he mentioned seventeen out of the nineteen leading shop executive positions in his plant that were filled by men who had started young with the firm, and who received all their practical training in the company's shops.

This is a remarkable record, but shows what can be done by systematic and continuous effort in the training of young men to take on future responsibility. The choice of men, who have risen from the ranks, for responsible positions has many advantages. They are familiar with the company's policy, they know the organization personally and have a thorough knowledge of the methods in the plant for solving unusual mechanical and other problems. Such experience can be acquired only through long years of association with one organization.

During the development period of any new industry, such as the manufacture of automobiles or airplanes, frequent changes and the infusion of new blood in the organization are desirable; but when a business has become fully established, it is safer to build an organization through the methods employed by the executive whose statements have been referred to above.

* * *

ELECTRIC DRIVES IN RAILROAD SHOPS

In considering motor drives in machine shops, it has been generally agreed that in a production shop group drive is to be preferred. In railroad shops, the conditions are quite different. There the individual motor drive practically becomes a necessity, because it is highly desirable to be able to run certain machines—to provide for an emergency job—when the rest of the shop may be closed down. Further, the individual motor drive in the railroad shop permits free use of overhead cranes, the machine tools may be placed in any location most convenient for the work to be performed, and, if suitable electrical equipment is provided, high efficiency and low maintenance cost are assured.

When new equipment is being installed in railroad shops at the present time, the individual motor drive is frequently specified, and if not, advantages almost certainly would be gained if it were. Railroad shop executives, in the older shops especially, will profit by considering this suggestion.

* * *

NEW USES FOR NON-METALLIC GEARS

Since the introduction of the fabric gear, treated with a chemical bond, about fifteen years ago, the use of this type of gear in many industries has increased to a surprising extent. Three times as many of these gears were made in 1927 as in 1924; and in the automobile industry alone about 3,000,000 gears of this type will be required during the present year.

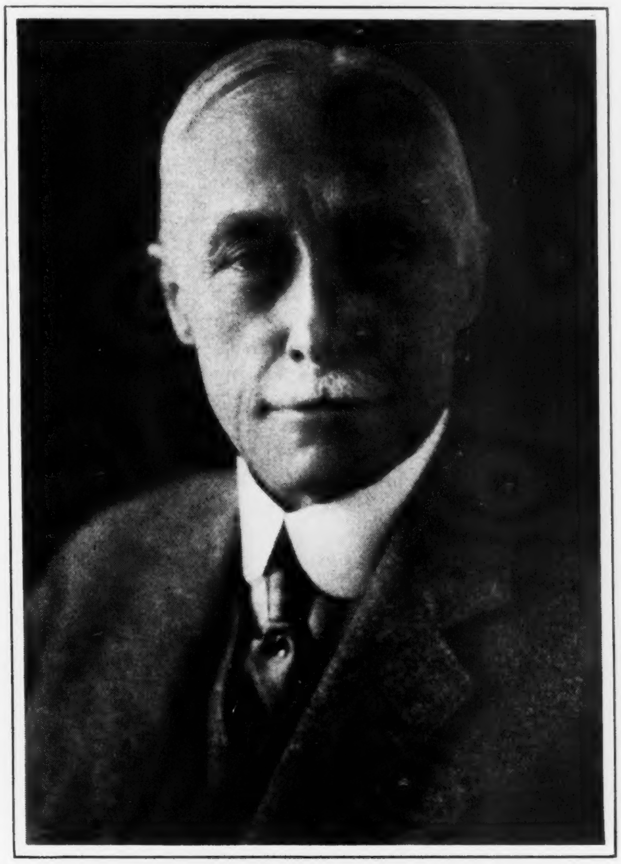
The reasons for this rapid increase in the use of the non-metallic gear are easily understood. They are silent as well as resilient; they reduce vibration and thereby lengthen the life of the apparatus of which they form a part; they run satisfactorily at high pitch-line velocities, and the tooth strength does not decrease so rapidly with increasing pitch-line velocities as in the case of metallic gears; and they have also been found suitable for use in a dust-laden atmosphere, such as in a cement mill, or in one filled with acid fumes, as in the pickling department of a steel mill.

It is evident that gears which can be used to advantage under so many varying conditions will be accepted widely by the industries, and the fact that the raw material from which they are cut is produced by large and responsible corporations, who have spared neither cost nor effort in perfecting the product, will insure a further increase in their use.

Elmer A. Sperry—Inventor and Engineer

ELMER Ambrose Sperry, chairman of the board of the Sperry Gyroscope Co., Brooklyn, N. Y., noted engineer, inventor, and manufacturer, has been elected president of the American Society of Mechanical Engineers for the year 1929. For nearly fifty years Mr. Sperry has been an unusually active and successful worker in a surprisingly wide field of engineering and applied science. He has obtained over 400 patents on inventions in the mechanical, electrical, and electro-chemical industries. He is perhaps best known for the development of the gyroscopic compass and the gyroscopic stabilizer for ships and airplanes, but these are only two of his many outstanding achievements.

Mr. Sperry was born in Cortland, N. Y., October 12, 1860. He attended the State Normal School and spent a year at Cornell University, but most of his training was obtained through his own efforts after leaving school. In 1879, when not yet twenty years old, he perfected one of the first electric arc lights, and was successful in securing its practical adoption. At the age of twenty he founded the Sperry Electric Co. of Chicago, and manufactured arc lamps, dynamos, motors, and other electrical appliances. At the age of twenty-three he designed and erected on Lake Michigan an electric beacon 350 feet high, the highest in the world at that time, which was equipped with arc lights totalling 40,000 candle-power.



Elmer A. Sperry, Newly Elected President of the American Society of Mechanical Engineers

In 1888 he was the first engineer to build electrical mining machinery. The equipment he built was widely used and marked a distinct advance in mining methods.

About 1890 he became a designer of electric street railway cars, and shortly afterward founded the Sperry Electric Railway Co. of Cleveland, Ohio, for the building of these cars. In 1894 these patents were purchased by the General Electric Co. He then designed electric motor vehicles and manufactured these for several years. In 1896 he drove the first American-built automobile in Paris, and subsequently a number of his electric "carriages" were sold there.

In the electro-chemical field he was equally active. He originated a process for caustic soda and bleach, which is still used, and the National Battery Co. was organized under his patents. He invented a detinning process for recovering tin from old cans and scrap, as well as an electrolytic process for producing white lead from the waste of copper mines. He also invented machinery for producing fuse wires, and it was on the basis of this invention that the Chicago Fuse Wire Co. was established. He has devoted much time and energy to the development of compound internal combustion engines using low-grade fuel oil. His compound Diesel engine for a given horsepower is about one-fifth the size and weight of the ordinary types.

In 1918 Mr. Sperry brought out a high-intensity arc searchlight, having a brightness five times greater than that of any light previously made. This has made possible indoor motion picture photography without sunlight. It has also proved to be a great aid in navigation, and has been adopted as the standard searchlight of the armies and navies of the principal countries of the world.

About 1896 Mr. Sperry turned his attention to making practical use of the principles underlying the toy known as the gyroscopic top. This truly amazing device appears to have been invented as a toy some time in the eighteenth century. It was studied scientifically by Foucault, a French physicist, about 1850. The gyroscope is a wheel with a heavy rim so mounted that it can spin very rapidly on its own axis. When friction is reduced to a minimum and the method of mounting and suspending eliminates restraints by other objects, the gyroscope tends to point its axis in a definite direction and to return to that direction if disturbed.

Mr. Sperry saw possibilities of great usefulness in this device. By diligent, tedious, and expensive

investigations and great ingenuity, overcoming many obstacles, he skillfully combined electrical and mechanical elements into successful gyroscopic compasses and gyroscopic stabilizers for ships and airplanes. Other applications of the gyroscope have also been devised by him. These inventions have been valuable contributions to the safety and comfort of navigation by sea as well as by air. In many respects, they are the most distinctive achievements of a remarkably prolific inventive mind, and certainly they are the most spectacular.

All these activities in the fields of invention, engineering, and manufacturing have not prevented Mr. Sperry from taking part in the work of the professional engineering societies. He is a founder member of the American Institute of Electrical Engineers and a member of the American Society of Mechanical Engineers, the American Chemical Society, the Society of Naval Architects and Marine Engineers, the Society of Automotive Engineers, the American Petroleum Institute, the National Aeronautic Association, and the Franklin Institute, as well as many other technical and scientific organizations. Mr. Sperry is also one of the Edison Pioneers.

It is eminently fitting that a man of Mr. Sperry's unusual achievements in the engineering field should be selected for the presidency of the largest organization devoted exclusively to mechanical engineering in the world.

Gaging Keyways Accurately

It has often been said that the progress in gaging methods has not kept pace with the development of production methods. Any contribution to the knowledge of accurate and convenient gaging methods is, therefore, of especial interest and value in the mechanical field, and the article by A. J. Cayouette of the White Motor Co. on accurate gaging methods for keyways and keyseats, which will be published in December MACHINERY, will prove of great value to those engaged in the design of gages. The study of convenient gaging methods is a branch of mechanical knowledge that requires careful attention, and for this reason, many designers and mechanics will welcome a new contribution to this interesting and important subject.

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STEEL FOUNDRY TRADE RULES

After considerable study of certain practices, some of which have gradually developed as the result of precedent, the Steel Founders' Society has adopted a set of "trade customs." These customs, as they were given in a recent issue of *Research Group News*, define the responsibilities of the producer and consumer in their business transactions and in carrying out orders. The adoption of such rules should prevent misunderstandings and promote cooperation between the producers and consumers.

1. When purchasers ask for quotations, they should give the actual or estimated rough weights of castings on which quotations are to be based.
2. Unless otherwise arranged, quotations should be accepted and pattern equipment furnished to the foundry by the purchaser within thirty days from the date of such quotations.
3. Unless otherwise specified, castings are sold as unmachined castings, f. o. b. the foundry. Terms of sale are net cash 30 days from date of invoice. No cash discounts are allowed.
4. Pattern equipment should be in proper condition and of a type suitable for the economical production of castings of the quality, quantity, and delivery required.
5. Before patterns are made, the purchaser should submit blueprints to the foundry that is to make the castings, to obtain suggestions concerning the best method for constructing the pattern equipment.
6. When the purchaser furnishes skeleton patterns, core-boxes, sweeps, or conjunction patterns which increase the cost of production of castings, an extra charge will be made.
7. Patterns should be painted in accordance with the following standard practice:

Surfaces to be left unfinished are to be painted black.

Surfaces to be machined are to be painted red.

Seats of and for loose pieces are to be red stripes on a yellow background.

Core-prints and seats for loose core-prints are to be painted yellow.

Stop-offs are to be indicated by diagonal black stripes on a yellow base.

8. Patterns, core-boxes, and loose pieces thereof shall be properly marked for identification.
9. Alterations and repairs on pattern equipment shall be paid for by the customer.
10. The foundry shall not be responsible for loss or damage to pattern equipment when caused by fire or other causes beyond its control.
11. The foundry shall not be expected to provide storage for patterns for which no orders have been received during a period of two years.
12. All transportation charges on pattern equipment to and from the foundry shall be paid by the customer.
13. Unless requested in writing, changes in orders will not be accepted by the foundry.
14. To be effective, cancellation of orders must be agreed to by both the foundry and customer.
15. After the original order is in production, the customer shall reimburse the foundry for castings made or for molds or cores discarded by the foundry due to cancellation, changes in orders, or alterations in pattern equipment.
16. The foundry shall not be liable for damages due to failure to make delivery of castings when such delay is caused by fires, strikes, accidents, or other and additional causes beyond the foundry's control.
17. Claims for errors in weight or in number of castings received shall be made by the customer within ten days after the receipt of the castings.
18. The foundry shall not be responsible for machine work or other expense incurred on castings that are later rejected as defective.
19. The foundry has the right to replace castings rejected by the customer as defective.
20. The foundry shall not be liable for any special, indirect, or consequential damages whatsoever, in connection with any castings it furnishes.

TOOLS FOR DRIVING-BOX WORK

By J. R. PHELPS, San Bernardino Shops, Atchison, Topeka & Santa Fe Railway, San Bernardino, Calif.

In locomotive repair shops, special tools and gages are often used in connection with work on driving-boxes. Several appliances of this kind used at the San Bernardino Shops are described in the following.

Checking Driving-boxes before Boring Brass

An attachment for a combination square used in setting driving-boxes for boring is shown at the

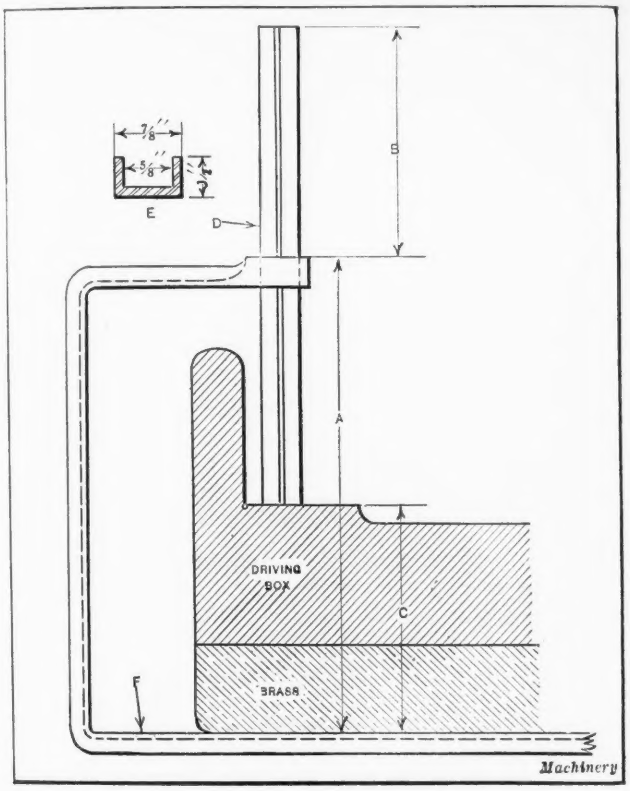


Fig. 1. Special Gage for Measuring Distance from Crown-brass to Saddle-seat

left in Fig. 2. This attachment consists merely of a wide blade, which is used in connection with an ordinary combination square to determine if the shoe and wedge faces are vertical, or square with the table, as it is very important to have these faces parallel with the axis of the crown-brass. The wide blade extends over the driving-box flange, thus per-

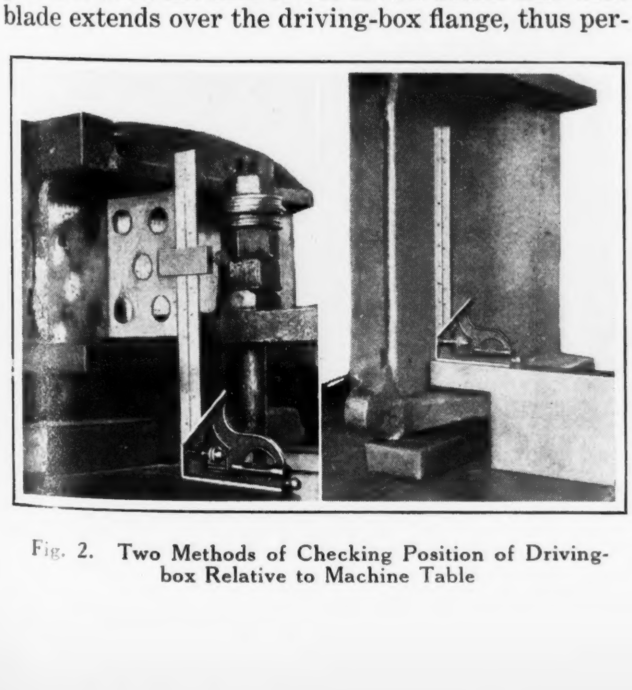


Fig. 2. Two Methods of Checking Position of Driving-box Relative to Machine Table

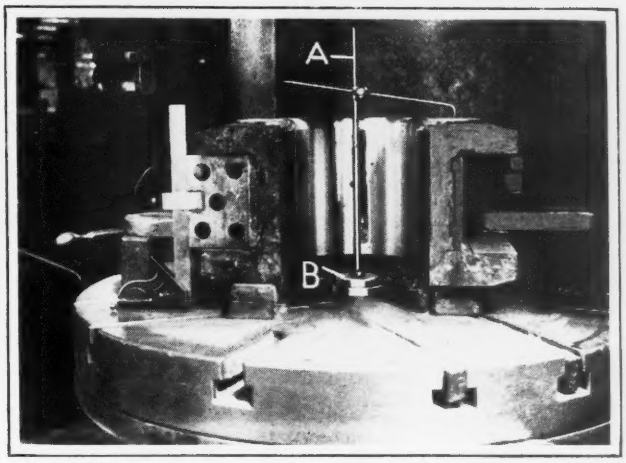


Fig. 3. Gage for Setting Driving-box on Table of Boring Mill

mitting the position of the shoe or wedge face to be checked. Although this test can be made by calipering between the regular square blade and the surface of the box, extra time is required for doing this, and a saving of about three minutes, obtained with the attachment referred to, amounts to a good deal in a shop where from 180 to 200 boxes are bored each month. The blade of this attachment measures 5 3/8 by 3 3/4 inches, and the thickness is 1/8 inch.

Another method of checking a shoe or wedge face is shown at the right in Fig. 2. A regular combination square is placed on a parallel having one

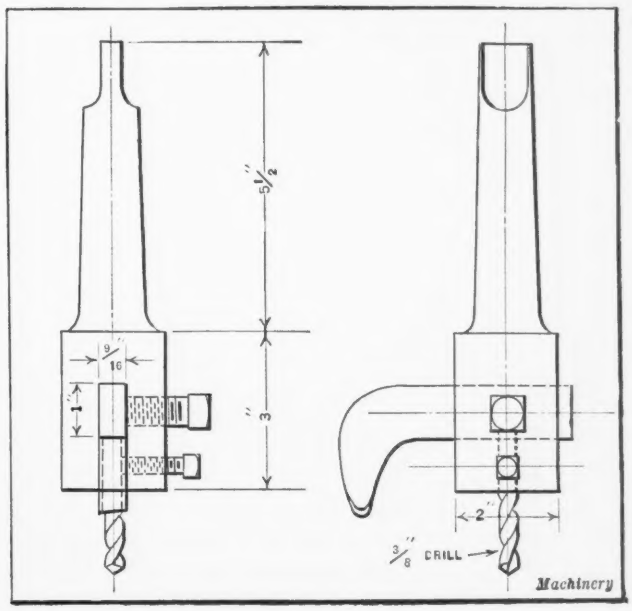


Fig. 4. Drill Press Tool for Cutting Oil-grooves in Faces of Shoes, Wedges, and Driving-boxes

corner cut out to clear the lower flange, as the illustration shows.

Crown-brass and Saddle-seat Distance Gage

A direct-reading gage which shows the distance from the crown of a driving-box brass to the saddle-seat is illustrated in Fig. 1. The dimension *C* is always the same as the distance *B* that scale *D* projects above the arm of the gage; consequently, the graduations on scale *D* show directly the dimension *C*. Scale *D* has a length of 12 inches, and distance *A* is also 12 inches; consequently, dimensions *B* and *C* must always be the same. The old

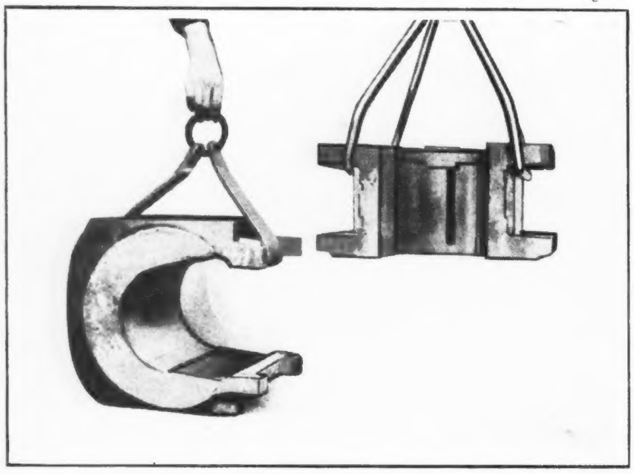


Fig. 5. Two Forms of Hooks or Slings Used for Lifting Driving-boxes

method of using a straightedge and subtracting one dimension from another to obtain distance *C* was likely to result in error, and the direct reading gage is easier to use and more reliable. The enlarged section shown at *E* represents the channel shape of the gage body, which is light but rigid. The lower section *F* of this gage is 24 inches long.

Setting Driving-boxes for Boring

The crown-brass of a locomotive driving-box should be bored so that the axis is midway between the shoe and wedge faces. Lines coinciding with the plane of the shoe and wedge faces are first drawn on the upper flange face. The gage shown at *A* in Fig. 3 is then used for setting the box by these lines, and also for adjusting it to avoid removing an unnecessary amount of metal from the crown of the brass. This gage is practically the same as a surface gage, except that the base *B* is a cylindrical plug fitting into the central hole in the boring machine table, and provision is made for turning the pointer from one side of the box to the other.

Tool for Cutting Oil-grooves

The tool illustrated in Fig. 4 is used for cutting oil-grooves either in shoe or wedge faces or in the corresponding faces of driving-boxes. This tool is intended for use in a drilling machine, and it is not necessary to clamp the work.

Hooks for Lifting Driving-boxes

Two forms of hooks or slings for lifting driving-boxes are illustrated in Fig. 5. The one at the left is intended particularly for lifting boxes on or off a planer, whereas the one at the right is used at the boring mill, as it holds a box in the position required for boring.

* * *

Eastern Europe, including the countries of Russia, Poland, Finland, Latvia, Esthonia, Lithuania, and the Free State of Danzig, are becoming increasingly important as a market for German machinery manufacturers, more than one-fifth of the total German exports of machinery in 1927 going to this district, compared with approximately 14.5 per cent in 1926. Beginning with 1924, machinery exports to Eastern Europe have grown steadily.

TURNING SMALL BRASS BALLS

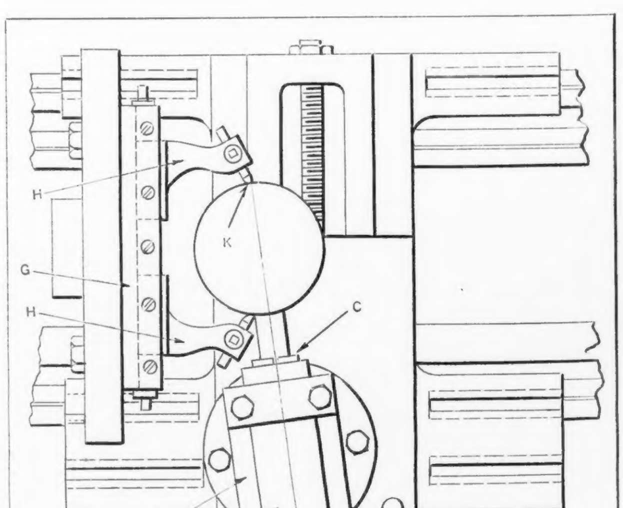
By JIM HENDERSON

Having a considerable number of small brass balls to be turned and no turret lathe available, the job was accomplished quite satisfactorily with a special attachment on a standard lathe in the manner here illustrated. The brass castings for the balls were made with shanks 3/8 inch in diameter. The balls were to be finished to 1 3/8 inches diameter.

The attachment consists of a frame *A*, with standards at each end to form bearings for the hollow shaft *B*. This shaft is recessed to fit in the bearings and prevent end play, and is bored to take the collet chuck *C*, which is tightened or loosened by the handwheel *D*. To shaft *B* is keyed the worm-wheel *E*, which meshes with the worm on the short cross-shaft, turned by the small handwheel *F*. The attachment is mounted on the cross-slide, with the center line of the fixture in the same plane as that of the lathe spindle.

To the faceplate of the lathe is secured the plate *G*, which carries two adjustable tool-holders *H*. The fixture can be set in any desired position in the horizontal plane, and is preferably set so that one turning tool cuts on a line that will intersect the center line of the fixture, as at *K*, while the other tool machines close to the ball shank.

The castings are held by their shanks, previously turned to 3/8 inch diameter, in the collet chuck *C*. Then, with the cutting tools properly adjusted, the work is gradually fed into position, and the wheel *F* slowly revolved. With the tools on the faceplate revolving, and the work revolving, it will be seen that the whole ball will be turned in one revolution of the work, except, of course, for the connection at the shank. A small grooved pulley may be placed on the worm-shaft inside the handwheel *F*, and a light belt drive used.



Attachment Mounted on a Lathe Cross-slide for Turning Balls

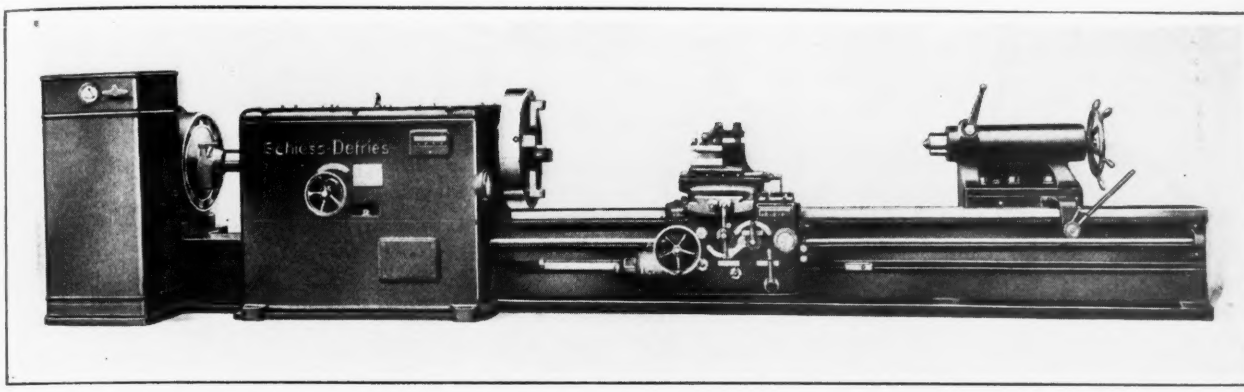


Fig. 1. German High-speed Lathe

A New German High-speed Lathe

By S. WEIL, Chief Engineer, Schiess-Defries A. G., Dusseldorf, Germany

A LATHE in which high-speed operation has been given special consideration has recently been built by Schiess-Defries, A. G., Düsseldorf, Germany. This lathe, which is shown in Figs. 1 and 2, enables steel shafts and similar work to be turned at a speed of 500 feet per minute, under continuous normal working conditions; with this machine, over 800 pounds of metal have been removed per hour.

The lathe is driven by a 35-horsepower direct-current variable-speed shunt-wound motor, with a ratio of 1 to 3. This motor is fixed on a plate at the rear of the lathe and transmits power to the back-gears in the headstock, which are completely enclosed by an oil- and dirt-proof housing.

The main spindle has a diameter of about 6 1/4 inches, and runs at speeds ranging from 20 to 600 revolutions per minute. A shaft 4 inches in diameter can be turned at a surface cutting speed of about 500 feet per minute, which requires the work to run at a speed of about 500 revolutions per minute. The changing of the back-gears to obtain any required spindle speed is accomplished by means of the handwheel located at the front of the spindle housing. In order to reduce friction losses, the main driving shafts are mounted in radial roller bearings. A special device forces lubricating grease into these bearings.

The carriage and the front and rear cross-slides have large, accurately fitted, supporting surfaces. A square turret-head with a capacity for holding four tools is mounted on the front cross-slide. The tool-block on the rear cross-slide can be adjusted from the front operating position, and is used for rough-turning long work.

The control levers are located on the apron of the machine. This enables the operator to keep the cutting tool under close observation at all times,

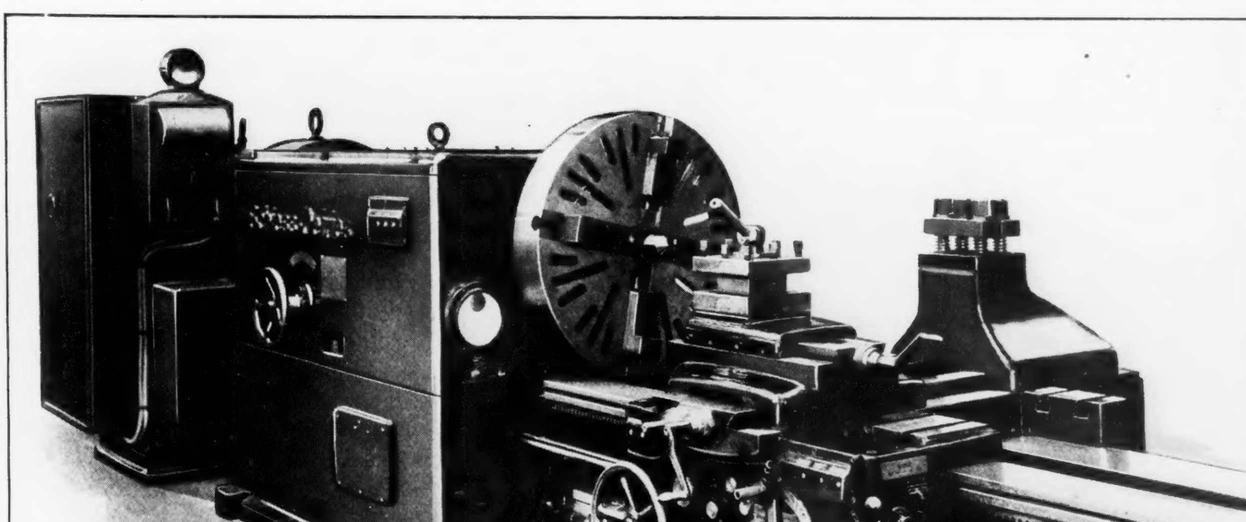


Fig. 2. Operating Controls of Lathe Shown in Fig. 1

and still be able to stop the machine or make any necessary changes at a moment's notice.

A special 3-horsepower motor mounted on the left-hand side of the apron is provided for the quick automatic traversing of the lathe carriage. The traversing speed is 40 feet per minute. Push-buttons for controlling the machine are arranged on the right- and left-hand sides of the apron, as shown in Fig. 2. The buttons on the right-hand side serve to control the main motor, while those on the left side control the quick-change motor which operates the traversing mechanism of the carriage. As the traversing movement continues only as long as the proper button is pressed, the operator must walk beside the moving apron. This feature compels the operator to remain in a position where he cannot fail to observe any obstruction to the forward movement of the carriage which might result in damage to the machine.

Electrically operated safety stops prevent over-running of the carriage on the machine bed. The longitudinal and the transverse movements have six rates of feed which range from 0.012 inch to 0.16 inch, and from 0.008 to 0.01 inch, respectively, per revolution.

A scale with an adjustable vernier is set into the ways of the machine bed. This scale permits the carriage to be quickly located at any desired point and enables the cutting tool to be fed along the work any required distance. Graduated dials are also provided to facilitate turning to exact diameters.

As the high spindle speeds make it impossible for the eye to gage the cutting speed, a tachometer is provided which shows the operator the exact spindle speed at all times. The tailstock is provided with a center, which turns with the work and is so mounted that it compensates for any expansion that may result from the heating of the work.

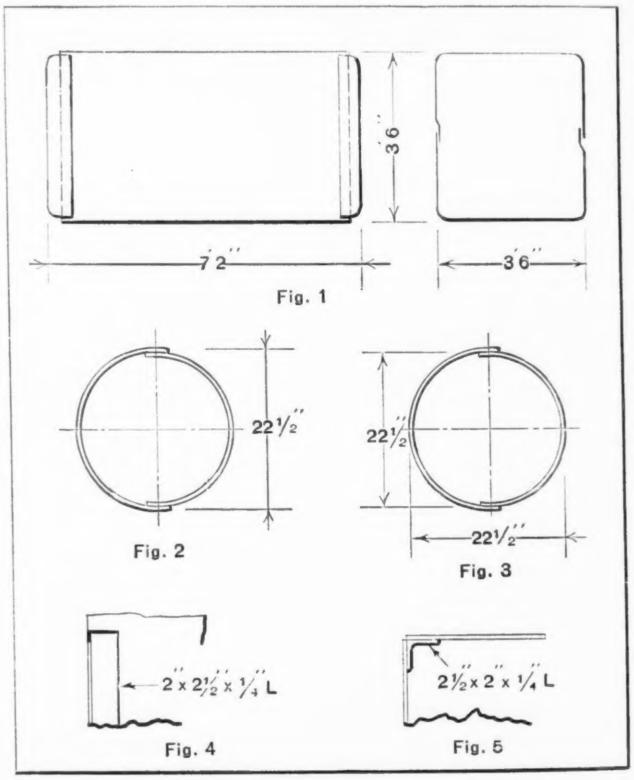
The chips, which are removed at the rate of from 770 to 880 pounds per hour, are broken up into small pieces as a result of the method of grinding the cutting edge of the turning tool. These small pieces drop through the chip holes located near the end of the lathe bed. Each of the operating levers is supplied with a brass plate on which operating instructions are inscribed. The lathe shown in the illustration has a height of centers of 15 3/4 inches, a center distance of 23 feet, and weighs approximately 16 1/2 tons.

The ability of any tool to withstand the high speeds of the machine described may be questioned by those who have had experience with only the usual grades of high-speed steel. It may be well, therefore, to mention that the steel used for the tools is known as "Widia Metal." This metal was developed by Friedr. Krupp, A. G., Essen, Germany. Satisfactory results have been obtained with this metal, which holds its cutting edge under extraordinary operating conditions. Doubtless other metals, such as "Stellite," "Celsit," "Cedit," etc., are also suitable for turning at the high speeds employed, although no data have yet been compiled regarding the use of these metals on the machine described.

DIMENSIONING SHEET-METAL PARTS

In addition to the method of dimensioning sheet metal described on page 659 of May MACHINERY, there is another method that has been in successful use in marine work for many years where it is impossible to show large size details of all parts.

Fig. 1 shows the method of dimensioning for a rectangular tank. For the greatest dimension, 7 feet 2 inches, the arrow heads are on the outside of the closure lines, pointing inward, which is contrary to ordinary mechanical practice, since there is, in this case, ample room to have the arrow heads inside the closure lines. To the man familiar with this system, the placing of the arrow heads in the positions shown means that the dimension 7 feet 2 inches is the over-all or outside dimension of the



Methods of Dimensioning Sheet-metal Parts

tank heads. On the other hand, the lateral dimensions, 3 feet 6 inches are understood to be inside dimensions, since the arrow heads are inside the closure lines.

In the circular section shown in Fig. 2, the dimension 22 1/2 inches is to the outside of the course nearer the dimension line (the inside course in this case), since the arrow heads are outside the closure lines. If the dimension line were placed on the other side of the section, as in Fig. 3, the arrow heads would have to be reversed, meaning 22 1/2 inches to the inside of the outside (or nearer) course. At the bottom of Fig. 3 is also given an alternative method of dimensioning.

A somewhat similar idea is applied to notes covering angles. In Fig. 4, the 2- by 2 1/2- by 1/4-inch angle has the flange whose dimension is named first, or the 2-inch flange in this case, in the plane of the paper; and in Fig. 5 the arrow points to the leg that is named first, so that the 2 1/2-inch leg is here located in a horizontal position. J. F.

Segmental Grinding Wheels

By FRED HORNER

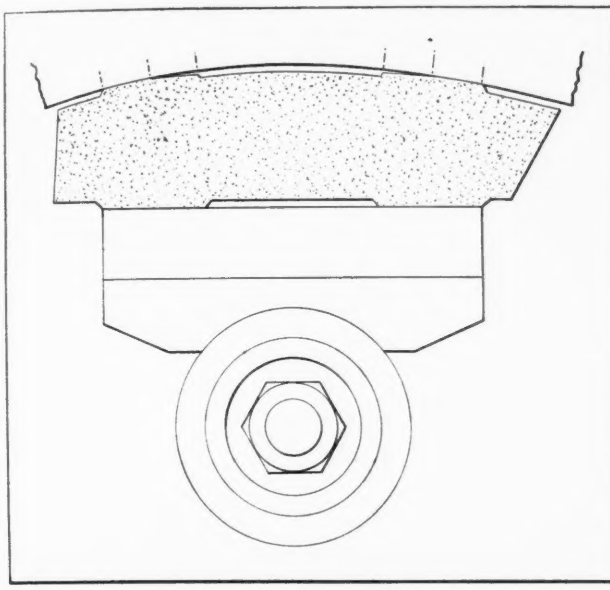


Fig. 1. Relieved Segment with Two Sets of Curves to Fit Chucks of Different Diameters

THERE are several reasons why the production of large ring wheels is not economical. For example, there are risks of breakage in manufacturing, transit, and storage, as well as in operation; the amount of scrap is considerable after the wheel has been worn down to the safe limit; fracture of the ring usually necessitates replacement, although some medium-sized wheels are run in a cracked state if bonded with wires or bands. Another objectionable feature of the complete ring is that it lacks provision for the escape of the ground material and the fragments of abrasive which become detached. Also the cooling water cannot gain free access to the work if it has a broad surface.

The development of the segmental wheel has consequently proceeded rapidly, being first applied to the large surfacing machines and later to machines using smaller wheels. The blocks or segments are simple and cheap to manufacture, can be replaced quickly, and can be used up to very short ends. Obviously, the waste material referred to will escape freely between the segments and the water will have free access to the work. The principal precautions to observe in designing segment wheels are to insure means for holding the blocks that will not subject them to tension sufficient to cause fracture, and to design the clamping screws and wedges so that incrustation will not interfere with their easy manipulation.

Avoiding Breakage of Segments

A method of insuring solid contact of the clamps on the segments is employed on the Norton wheels which are applied to the Diamond Machine Co.'s chucks. The segments have a clearance, as shown in Fig. 1, instead of having the back molded in a continuous curve. In the latter type, warping may result if the curve fits the chuck only at the center, or else at the ends. Under such conditions, the clamping pressure sets up a tension that causes fracture, either at once or during operation.

A double purpose is served if the back of the segment is molded as shown in Fig. 1, with radii to conform with two arcs, such as required for a 30-inch and a 36-inch chuck. Requirements can thus be filled from stock more readily than when each size of chuck requires a different kind of segment. Twelve segments like the one shown in Fig. 1 are used in the 30-inch and fifteen in the 36-inch chucks.

In Fig. 2 is shown the construction of the Diamond chuck, with steel and brass wedges, while the detail at *A* shows the application of a filling-in ring, four of which are furnished, each 1 1/4 inches thick. Consequently, 6 7/16 inches of a wheel 7 1/4 inches deep can be used. This design provides a solid backing for the segments at all times.

Segmental Chuck for Surface Grinding Machine

The Norton segmental chuck shown in Fig. 4 is designed for use on the No. 16 Blanchard high-power surface grinding machine. This chuck holds eight segments, as indicated in Fig. 5, giving a

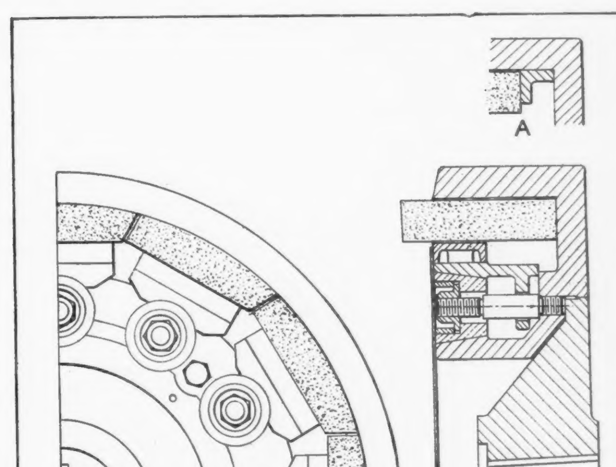


Fig. 2. Chuck of Segmental Grinding Wheel Provided with a Filling Ring at A

wheel 18 by 5 inches which is run at a speed of 860 revolutions per minute. As shown in the dismantled view, Fig. 4, the backing ring is adjustable to three different settings by means of the slots in the chuck. Commencing with new segments, the backing ring is placed in the slots nearest the faceplate, as shown in Figs. 4 and 5. Four wedges are used to lock the eight segments. These are 6 inches long and weigh slightly over 5 pounds each.

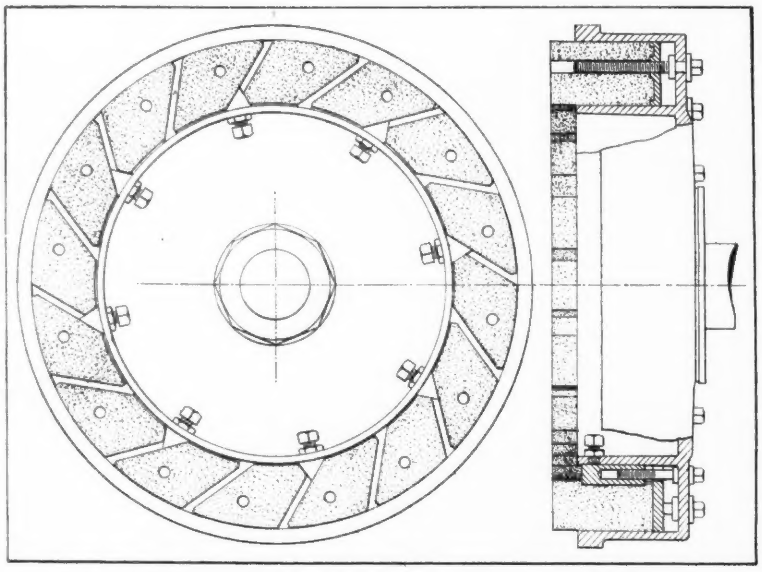


Fig. 3. Chuck with Segments Positioned to Give Shearing Cut

Segments Positioned for Shearing Cut

An unusual design of segment appears in the wheel of the Bridgeport Safety Emery Wheel Co.'s heavy-duty face grinder, as shown in Fig. 3. The blocks are so positioned as to give a shearing cut. Their clamping is effected by wedges that can be adjusted forward as required, and the carriers provide means for feeding out as wear occurs, thus permitting nearly the whole amount of abrasive to be used up. The chuck body is of cast steel.

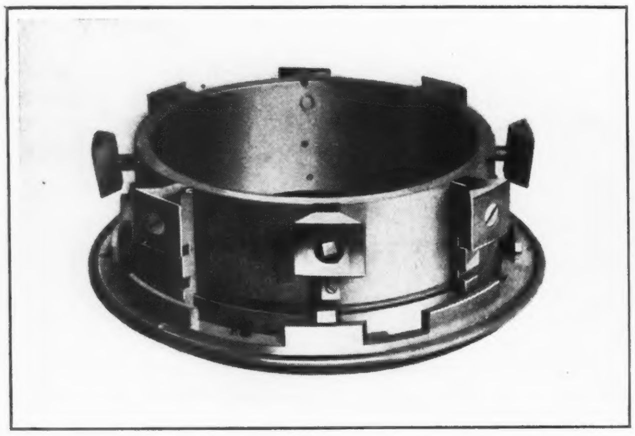


Fig. 4. Chuck Designed to Hold Eight Abrasive Segments

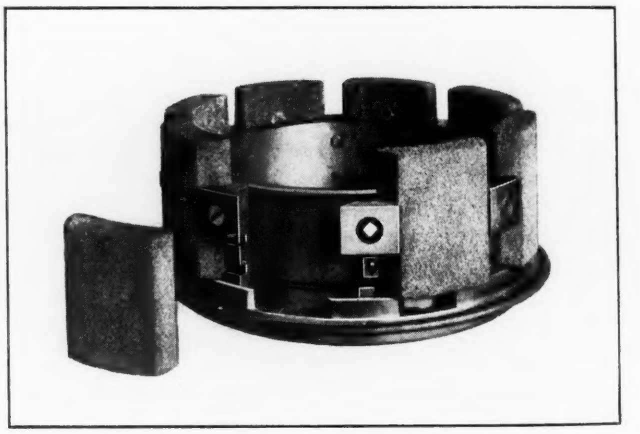


Fig. 5. Segments Mounted on Chuck Illustrated in Fig. 4

The heavy vertical-spindle grinding machines made by John Lund of Crosshills, Nr. Keighley, England, have segmental wheels of two types, inside and outside. The inside type, shown in Fig. 6, has a steel center casting, with a steel retaining ring shrunk on. The arms of the center terminate in bevels which fit the segments, while a bronze clamping wedge tightened with a bolt is located between each pair. The chuck is 6 3/4 inches wide and the segments 12 inches long. For the outside style shown in Fig. 7, a steel casting is used which has flats for the blocks to rest on, and the bronze dies have a lead filling, as indicated, in order to give a gentle and equable pressure. Both the inside and outside wheels have an effective diameter of 25 inches.

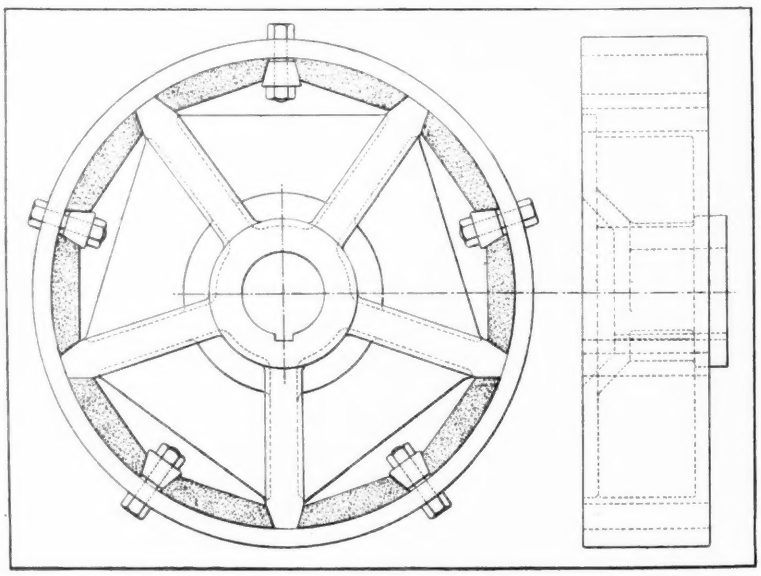


Fig. 6. Inside Clamping Type of Chuck

Tasker's Engineering Co., Ltd., of Sheffield, England, who make numerous heavy face grinding machines, including armor-plate machines of 120 horsepower, weighing 60 tons, employ the special wedge device shown in Fig. 10, which can be very quickly operated. The details comprise an adjusting screw with a fine square thread, and a wedge actuated by the screw, which has tongues that fit the side plates to prevent them from floating. The taper side plates make contact with the two flanks of the segments as shown.

With this design, the operator can lock the segments quickly, as it is only

necessary to tighten the clamping screw just enough to prevent the wedges and side plates from moving. As soon as the disk is rotated, the centrifugal force tends to throw the screw and the wedges outward, thus completing the locking action. The same arrangement can be used for single-side taper blocks. It will be apparent that only a light tap on the head of the clamping screw is required to release all the wedges and thus leave the segments free for adjustment or removal from the chuck for replacement when they have become worn out.

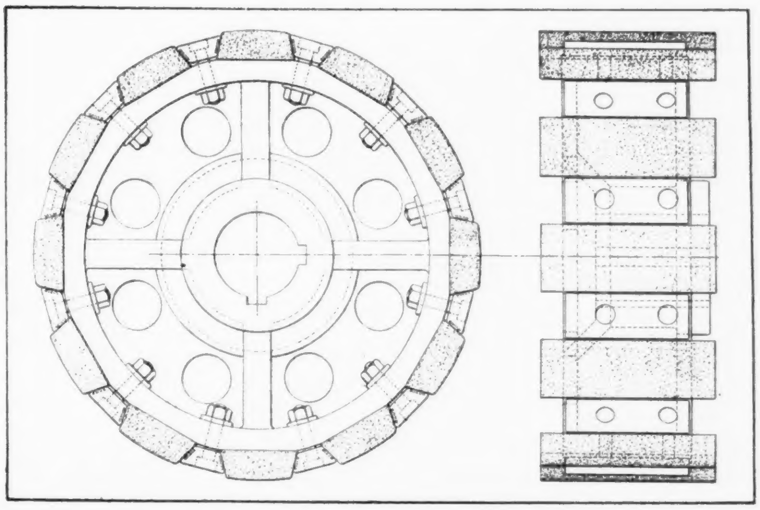


Fig. 7. Chuck with Segments Clamped on Outer Surface

A simple method of holding the segments, which positively locks them in place and yet permits them to be easily adjusted or set forward as required, is shown in Fig. 9, where the chuck rim is corrugated and the segments formed to match. Loosening the intermediate wedge blocks sufficiently to enable the segments to be lifted off the corrugations provides means for resetting. This is a new type made by Messrs. B. R. Rowland & Co., Ltd. of Reddish, Nr. Stockport, England.

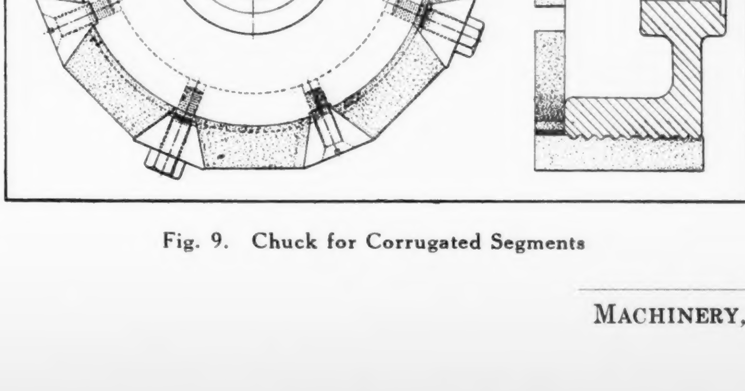


Fig. 9. Chuck for Corrugated Segments

Fig. 11 shows the construction of a 36-inch wheel employed by Luke & Spencer, Ltd., Broadheath, Manchester, England, for various machines. It is of simple design, and can be machined all over to insure accurate balance. There are no projections, the outer ring being of mild steel, which acts as an effective guard and among other things, reduces the air draft. By removing one screw, two segments can be adjusted. The clamping wedges are self-centering, taking up any irregularities in the segments.

A 14-inch wheel, typical of the line constructed by Snow & Co., Ltd., of Sheffield, England, is shown in Fig. 8, the blocks being pressed out against a steel ring surrounding the body. The pressure is provided by floating jaws moved by a special arrangement of a screw and nut which is easily accessible. The segments used for this size of wheel are 9 inches long. The firm employs this style on an extensive range of grinders.

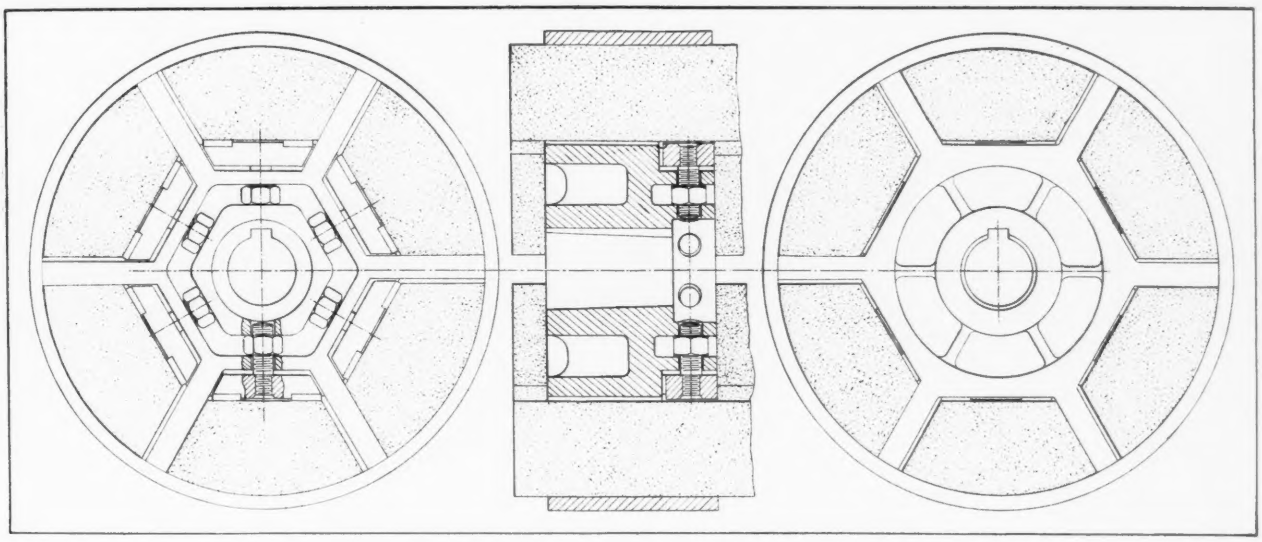


Fig. 8. Chuck with Segments Locked in Place by Screws and Pads

Conical Shaped Chuck

The conical shape shown in Fig. 12 is used for the Churchill segmental wheels of the Churchill Machine Tool Co., Ltd., Manchester, England. This shape is found to resist heavy cutting pressure without deflection. The body

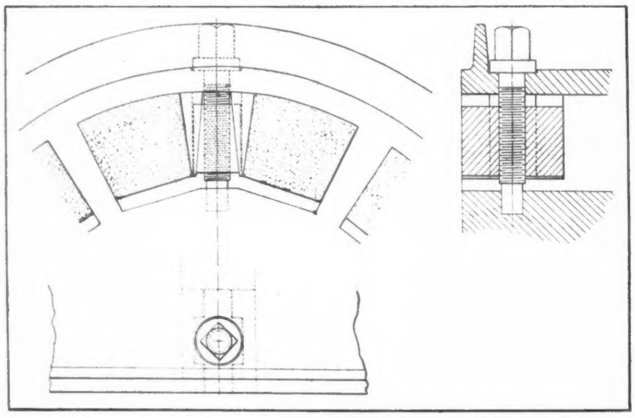


Fig. 10. Chuck with Screw and Wedge Fastening Arrangement which Tightens as Wheel Rotates

is bolted direct to a large flange forged on the spindle, and a strong steel guard ring is attached to and revolves with the chuck. A special feature is that no screws are exposed to the centrifugal action of the cooling liquid, and the only portion of the segments exposed to the fluid is that projecting from the wheel body. This is of some importance, as certain types of bond are likely to be affected by the moisture. No difficulty in adjusting the segments endwise results from incrustation. The section *X-X* shows the wedge fitting. A screw and thrust carrier permits each segment to be adjusted, and prevents subsequent slippage. It will be noted that the stationary water-guard has handwheel and screw adjustment for quick setting to suit the amount that the segments project.

Segmental Wheels with Ring Adjusters

In the segmental wheel chuck sold by the Carborundum Co., Niagara Falls, N. Y., which is made by the Pratt & Whitney Co., the abrasive segments are held within the chuck skirt by upper and lower clamps provided with rocker shoes which compensate for unevenness in the segments. The clamping bolts are located between the ends of the segments and can be easily tightened or loosened from the outside of the chuck.

The segments, when new, rest directly on the top of the chuck, as shown in Fig. 13, and when worn and reset in the second position, they rest on the top of the inner clamps, as shown in Fig. 14. The lower clamps in this case are pulled forward by the bolts. In every case the segments are driven by the heavy partitions that are integral with the chuck body. As the centrifugal force and the crushing strain on the segments are absorbed by the chuck body, the strain on the clamps is comparatively light. In Fig. 15 is shown a method of holding the adapter in which the worn segment has been set.

To promote standardization, the chucks designed for the 22-inch Pratt & Whitney surface grinders and the 16- and 18-inch Blanchard surfacing machines all carry one standard shape of "Carborundum" or "Aloxite" segment. These segments are 6 inches long, 7 inches high, with a 2-inch face. The 22-inch Pratt & Whitney machine chuck takes eight segments. The 16-inch and 18-inch chucks for the Blanchard machine take six segments.

The Carborundum chuck designed for the 14-inch Pratt & Whitney grinders carries "Carborundum" or "Aloxite" segments 4 1/2 inches long, 6 inches high, with a 1 1/2-inch face. There are six segments to a set for this chuck. In the case of the Blanchard machines, the water supply is directed through a series of six brass tubes, 1 inch in diameter, inserted in the water ring or channel of the adapter plate. The water is carried downward along the

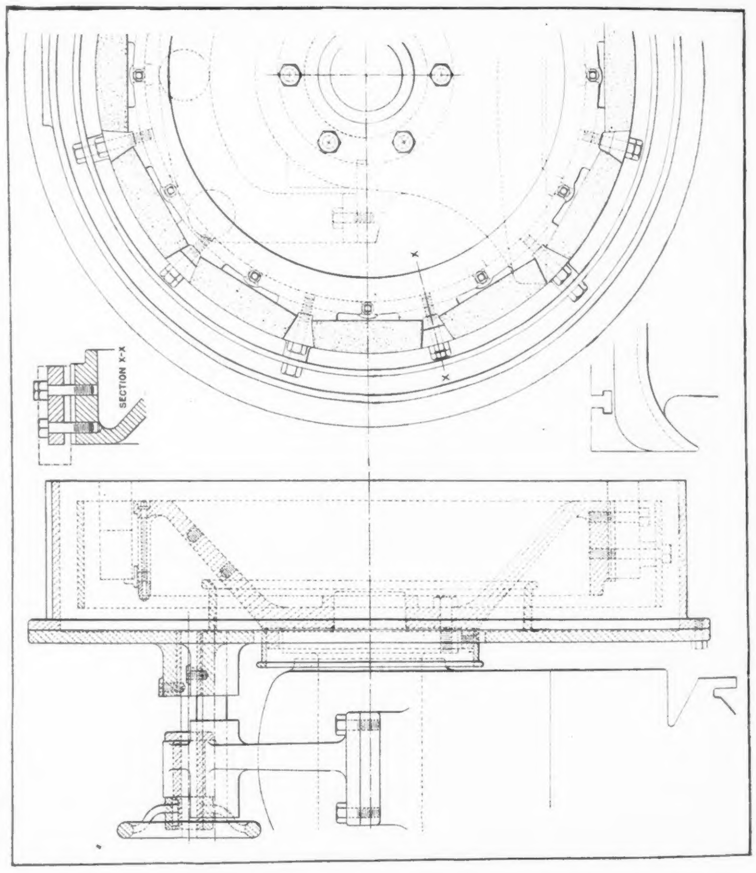


Fig. 12. Grinding Wheel with Segments Clamped in Place by Wedges and Screws for Adjusting Endwise Positions

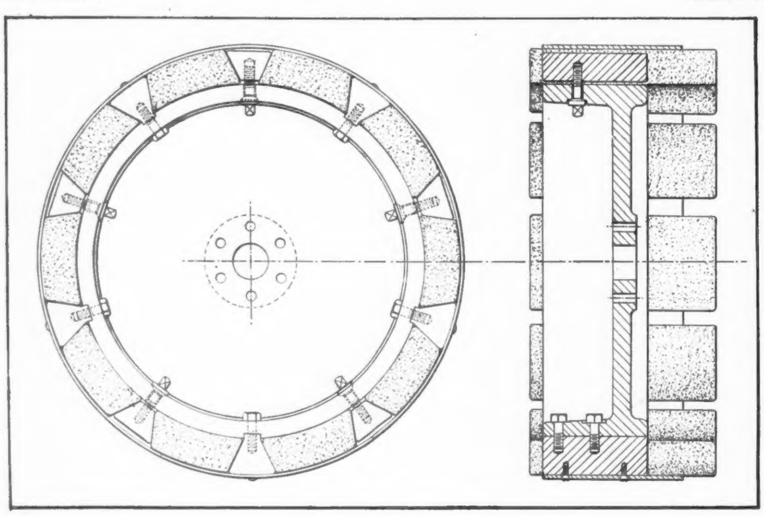


Fig. 11. Segmental Grinding Wheel with Wedge

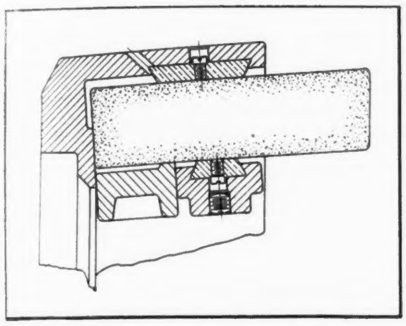


Fig. 13. Method of Holding New Segment

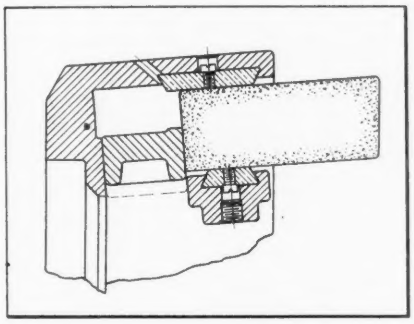


Fig. 14. Inner Clamp Used to Support Segment

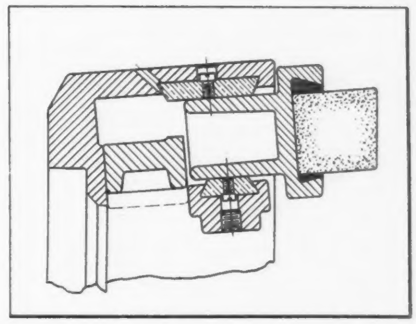


Fig. 15. Adapter for Holding Worn Segment

sides of a distributor in the form of a solid metal ring mounted inside the chuck body. The water, being driven against the distributor by centrifugal force or action, is forced to the point of grinding contact in and about the segments. In the Pratt & Whitney surface grinding machines, water is supplied to the segments through the hollow spindle of the grinder proper.

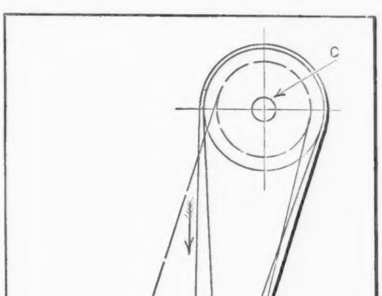
* * *

MISTAKES IN LAYING OUT BELT DRIVES

By B. J. STERN

Recently the writer had occasion to lay out the floor plan of a shop for making wooden boxes, in which several special machines were to be installed. These machines had already been designed and were nearing completion in the machine shop. In calculating the various shaft speeds and machine speeds required, it was necessary to go over the design of the special machines. It was found that the position of one of the pulleys on one machine was such that it could not possibly be driven from the shaft as planned by the designer. This is a condition that the writer has often observed on special machines.

The machine in question was designed to mill several notches in wooden box battens. It contained four parallel cutter-spindles located in the same horizontal plane and driven by individual pulleys, one of which is shown at *A* in the accompanying illustration. All four spindles were to be driven by individual quarter-turn belts from a drum on the shaft *C*. Another pulley *B* was to be used for driving the mechanism that gripped and fed the battens past the milling cutters. This pulley was placed parallel with the spindle pulleys, but much further back, and it was intended to be driven by a quarter-turn belt from the same shaft *C* that drove the cutter-spindles. A glance at the illustration will show the conditions outlined.



Arrangement of Drive Belts on Special Machine

In MACHINERY'S HANDBOOK (page 757 of the sixth revised edition) it is stated that "in an angular drive, the center of the face of the driven pulley must be aligned with the center of that face of the driving pulley from which the belt leaves." It is obvious that the drive, as shown in the illustration, does not meet these requirements and that it would not function.

It is evident that the feed pulley *B* cannot be readily driven by a quarter-turn belt from the same shaft that drives the cutter-spindles without unduly complicating the drive. As it was impossible to move the feed pulley into the same plane as that of the cutter pulleys, it was necessary to introduce a pair of miter gears in the feed drive, which brought the feed parallel with the plane of the drive shaft so that the pulley *B* could be driven by a straight open belt from shaft *C*.

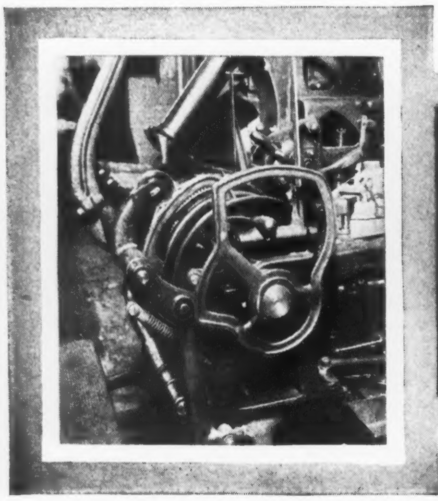
The case cited shows how carelessness or insufficient attention to details of the belt drives of machines may necessitate redesigning and cause considerable delay in putting new machines in operation. It would be well if designers would give more serious thought to the final belt drives of special machines.

* * *

NICKEL IN CAST IRON

Nickel in cast iron tends to refine the grain; to increase the hardness, resistance to wear, and strength; and to eliminate porosity. Nickel also improves the machineability of cast iron. By its use, cast iron of 250 Brinell hardness is as readily machined as ordinary cast iron at 200 Brinell. The increase in the wear of castings when nickel is used is due first to increased hardness, and second to finer structure and freedom from carbide particles, which act as a lapping compound and increase the wear. The characteristics mentioned are exhibited by the addition of nickel alone, but other metals, such as chromium, have an advantageous effect.

Cast iron with nickel alone or in combination with other elements is now used for a wide variety of purposes, such as automobile cylinders and pistons, differential spiders, Diesel-engine cylinders, machine tool beds, hydraulic press castings, valve and pipe-fitting castings, electrical-resistance grids, pipe balls, steam-cylinder bushings, and rolls for steel mill service.



Ingenious Mechanical Movements

WORM DRIVE FOR SLOW-MOVING SLIDE

By J. E. FENNO

A novel method of converting a high rotary speed into a very low straight-line motion consists in using two worms *A* and *B* (see accompanying diagram) which differ very slightly in pitch and which mesh with opposite sides of a worm-wheel mounted on the part that is to receive the slow straight-line motion. Worm *B* is driven directly by pinion *C* and gear *D*, and worm *A* is revolved in the opposite direction through the provision of an idler gear *E* between pinion *C* and gear *F*. The worm-wheel *G* turns freely on a shoulder stud which is held in slide *H*.

Worm *B* has six threads per inch, and worm *A*, 5 31/32 threads per inch, all threads being right-hand. Now if the pitch of both worms were exactly the same, no motion would be transmitted to slide *H*, but as there is a difference in pitch equal to 1/1146 inch, the center of the worm-wheel and slide will move one-half this amount or about 0.0004 inch per revolution of the worms, or 0.0002 inch per revolution of the driving pinion *C*, as the latter has 15 teeth, whereas gears *D* and *F* each have 30 teeth. When the slide *H* reaches the end of its stroke, engagement of a dog with a suitable trip operates a clutch and the traversing movement of the slide is reversed.

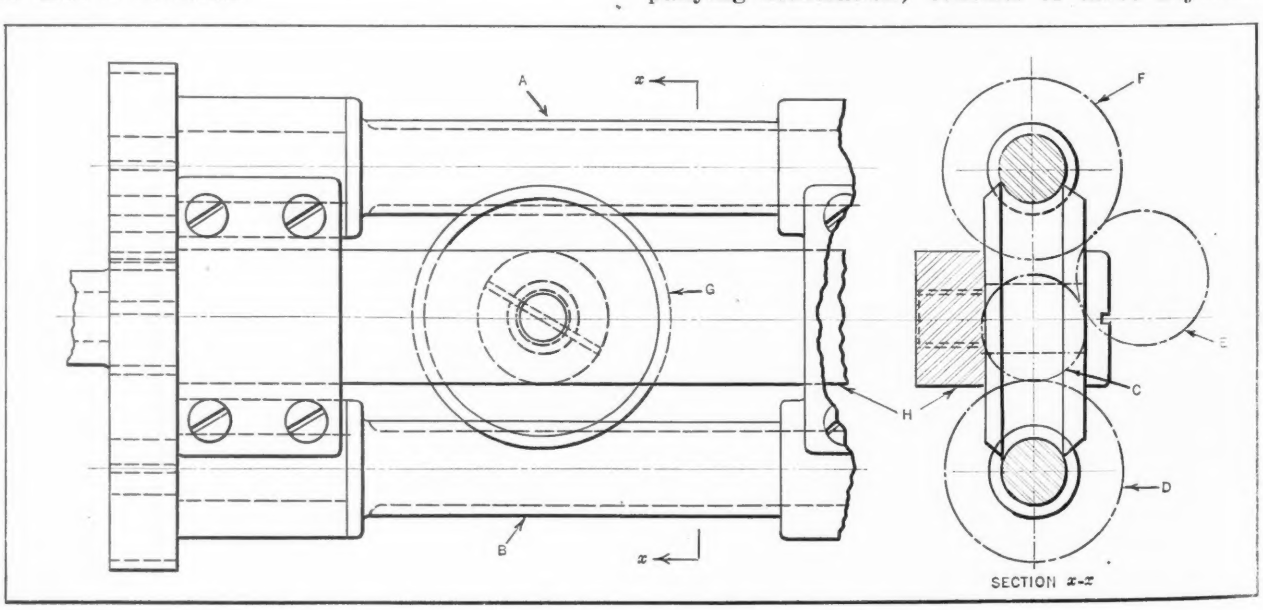
VARIABLE FEEDING MECHANISM

By R. E. McCOY

The variable feeding mechanism described in this article is part of a special paper-cutting machine used in making certain sales books for retail stores. These books are made in seven different widths varying from 3 3/8 to 7 1/4 inches. To economize in printing them, pads 14 3/4 inches long and containing from two to four printed books are assembled, and then the adjacent books are cut apart. In connection with this cutting operation, the variable feeding mechanism is used to feed the pads under the knife intermittently, and with increasing or decreasing lengths of feed to suit the various book lengths and also the different spacings required for "trim" between the books and between successive pads. For example, in producing books 3 3/8 inches wide, three different lengths of feed are necessary (6 1/8, 3 3/8, and 1/4 inch), and these movements must occur in the proper sequence.

Owing to irregularities in the printing of these books, which is done on rotary presses, adjustments must be provided for all cuts through the pads, and these adjustments must be independent of each other, so that one adjustment will not disturb any of the others.

The feed mechanism employed (see the accompanying illustration) consists of three adjustable

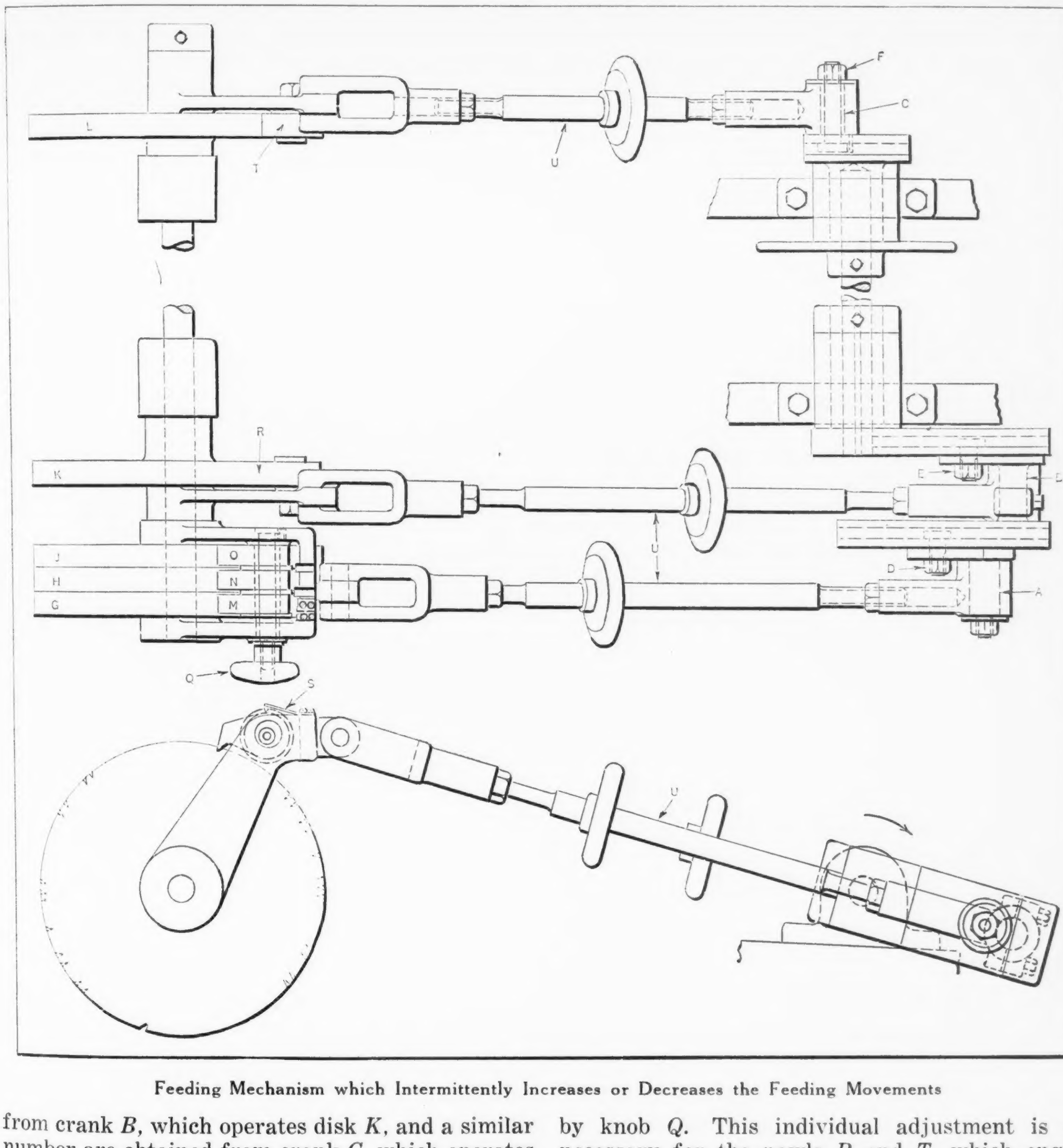


Mechanism for Reducing a High Rotary Speed to a Slow Straight-line Motion

cranks, each of which transmits the required feeding movement through a special ratchet mechanism. The radial position of the three crankpins *A*, *B*, and *C* may be varied by means of square-head bolts *D*, *E*, and *F*, which engage T-slots cut in the crank faces. The cranks are graduated on their edges to show the different radial positions for the various throws required. Crank *A*, which transmits feeding movements to either one of the three disks *G*, *H*, or *J*, provides for seven of the spacing or feeding movements. Three of the movements are obtained

3 3/8, 3 5/8, 4 1/2, 4 3/4, 5 3/4, 6 3/4, and 7 1/4 inches. Disk *K* is notched for movements of 6 1/8, 7, and 9 3/4 inches. Disk *L* is notched for movements of 1/4, 1/2, and 1 1/2 inches.

The pawls *M*, *N*, and *O*, which engage ratchet disks *G*, *H*, and *J*, are mounted on eccentric bushings, which are notched on the edge and are held in position by spring *S*. This eccentric mounting permits individual adjustment, which is necessary to care for the variation that occurs in printing. After the eccentric bushings are set, they are locked



Feeding Mechanism which Intermittently Increases or Decreases the Feeding Movements

from crank *B*, which operates disk *K*, and a similar number are obtained from crank *C*, which operates disk *L*.

Only enough teeth are cut in the edge of each feed disk to provide for the required feeding movements. These disks have a circumference of 34 inches, which is equal to twice the distance between two uncut packs of books when placed end to end; consequently, the notches are spaced around the disks in proportion to the distances between the books. Disks *G*, *H*, and *J* have just enough teeth or notches to provide the following movements:

by knob *Q*. This individual adjustment is not necessary for the pawls *R* and *T*, which engage ratchet disks *K* and *L*.

The connecting-rods *U*, which transmit motion from the cranks to the pawl levers, have right- and left-hand threads at the ends for varying the lengths, in order to locate the pawls in the proper positions relative to the notches in the ratchet disks. Small handwheels on the connecting-rods are used in making these adjustments, and lock-nuts are provided at each threaded end to prevent any change in the adjustment due to vibration.

This type of feed mechanism makes it possible to control each feeding movement independently of all the others, and the adjustments when setting up the machine are comparatively simple. The use of ratchet disks which are notched only where actually required reduces wear and eliminates the noise that would result if the pawls were drawn over teeth on the return strokes. The particular machine on which this mechanism is utilized has a capacity of 55,000 books per eight-hour day. While the mechanism illustrated is special for this particular cutting operation, a similar design doubtless could be applied to other classes of machinery requiring a variable feeding or indexing movement.

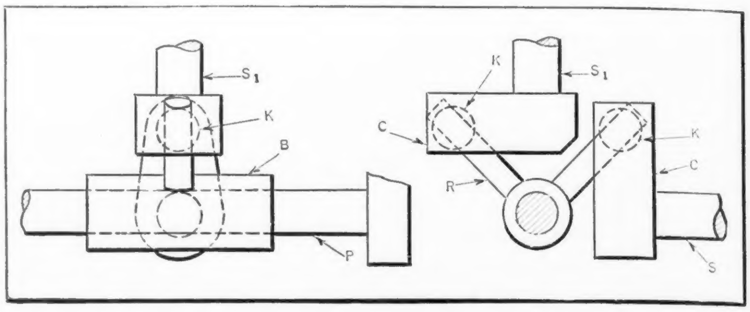


Fig. 2. Transmission Shown in Fig. 1 Applied to Shafts Located at Right Angles

* * *

DEVICE TO ROTATE ALIGNED SHAFTS SYNCHRONOUSLY IN OPPOSITE DIRECTIONS

By HERBERT A. FREEMAN

Two shafts which are in alignment are rotated synchronously and in opposite directions by the simple arrangement shown by the diagram Fig. 1. The two shafts S and S_1 have cranks of equal throw. On the outer ends of these cranks are universal joints. Balls K are shown, but any equivalent joint is satisfactory. The arms R of rocking beam B are free to slide through holes in balls K. This rocking beam is free to move axially and rock upon fixed shaft P, which is located at right angles to shafts S and S_1 and in their planes. This fixed shaft is also midway between the planes of rotation of the ball centers.

This is a flexible arrangement, as it may be applied to shafts located at any angle. Fig. 2 illustrates shafts at right angles. The connecting member is the same in principle. The arms of the rocking beam are at right angles, and the axis of the fixed shaft in this case is at the vertex of the angle made by the driving and driven shafts. If the driving and driven shafts are not in alignment, the rocker arms must be offset the same amount as the shafts. One driver using one rocking beam and having arms suitably arranged can operate a number of shafts parallel to the driving shaft or making an angle to it, provided the driving and driven shafts have a common plane; or in case the driven members are angularly disposed, provided the planes of the driven members have a common vertex through which the axis of the driver passes.

This mechanism is adapted for complete enclosure and oil-immersed operation. This form of transmission was applied where gears were not desired, although if gears had been used, five would have been necessary.

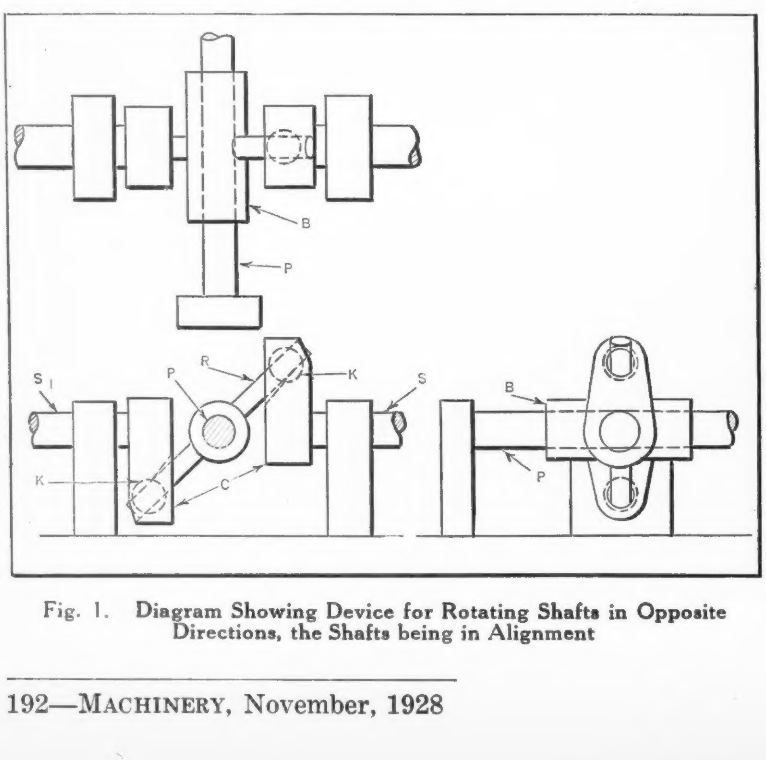


Fig. 1. Diagram Showing Device for Rotating Shafts in Opposite Directions, the Shafts being in Alignment

* * *

WESTERN METAL CONGRESS AND EXPOSITION

During the week January 14 to 18 there will be held, under the auspices of the American Society for Steel Treating, a Western Metal Congress in Los Angeles, Calif., at which technical sessions will be held pertaining to the making, working, treating, and use of metals. Simultaneously with the Metal Congress there will be held in the Shrine Auditorium in Los Angeles, the first metal and machinery exposition ever organized in the West. The exhibition will cover the same general field as the well-known expositions of the American Society for Steel Treating that are held annually in eastern manufacturing centers. Further information may be obtained by communicating with the American Society for Steel Treating, 7016 Euclid Ave., Cleveland, Ohio.

* * *

MECHANICAL ENGINEERING EXPOSITION

The seventh national exposition of power and mechanical engineering will be held in the Grand Central Palace, 480 Lexington Ave., New York City, December 3 to 8. A large number of exhibitors will be represented—nearly one hundred more than last year. The exhibitions are divided into the following classifications: Power, heating and ventilating, refrigeration, machine shop equipment, material handling equipment, safety appliances, and miscellaneous engineering and industrial equipment. Three floors of the Grand Central Palace are completely filled and a large part of the fourth floor has also been contracted for. A widespread interest in the marine industry will be evidenced by exhibits of equipment applicable to this field.

ARC-WELDED SHOP FLOOR PLATES

Some time ago several of the assembly and test floors in the East Pittsburgh Shops of the Westinghouse Electric & Mfg. Co. were made of fabricated steel, as shown in Fig. 1. These plates have proved more satisfactory than the old type plates of heavy cast iron which they replaced. The present practice of bringing the machine to the job, rather than

Fig. 1. Arc-welded Floor Plate

the job to the machine, imposes unusual stresses on the floor plates.

The method used in the fabrication of the type of floor plate shown in Fig. 1 is quite simple. A number of I-beams are laid upon the plates that are to form the working surface, and welded in place. The I-beams and plates run at right angles to each other. The plates that form the bottom are then laid on the I-beams and welded to them, thus completing the assembly.

Bolts are embedded in the concrete bed which is to receive the floor plates. The ends of the bolts that project from the concrete pass through pieces which rest on the lower flanges of the floor plate I-beams. The fabricated floor plates must, of course, be turned over after being assembled. The plates are carefully leveled, low spots being raised by means of shims placed under the bottom plates. When finally leveled, the spaces around the plates and the lower flange of the I-beams are grouted in. The floor plate is ready for use as soon as the concrete has set.

The construction details of a more recent and improved type of arc-welded floor plate are shown in Fig. 2. Floor plates of this type have recently been built and installed at the same plant, and while slightly more costly than the type of arc-welded floor plate just described, cost only about half as much as the old cast-iron type. As in the older fabricated steel type, the floor plate is built upside down and righted after completion.

All the pieces are first cut to length and to the required shape, after which the surface plates are laid on a level surface and spaced as in the finished piece. A channel iron is placed, with the channel down, over each space between the plates, and is welded to each of the two adjoining plates. This procedure is continued until all the spaces between the plates are covered. A strip of plate the same width as the channel flanges is butt-welded to each of the side surface plates. The I-beams are then laid on the channels at right angles to them and welded in place.

The bottom plates are next welded to the I-beams, and the whole structure then turned right side up. After this has been done, the surfaces of the floor plates are planed and several small holes are cut in the surface plates to permit grouting to be poured around the base. Bolts are set in the unfinished foundation for the bed plate. These bolts hold the floor plate in position while the concrete grouting is being poured and while it sets.

The great advantage of this type floor plate over the older type is that no dirt can collect under the surface plates. Any water or oil will run down the channel iron to gutters at the ends of the plate, and the channels can be cleaned quickly and easily. The floor plate shown in Fig. 2 is 15 feet long by 7 feet 9 inches wide, but the same type of construction can be employed for plates of any desired shape or size.

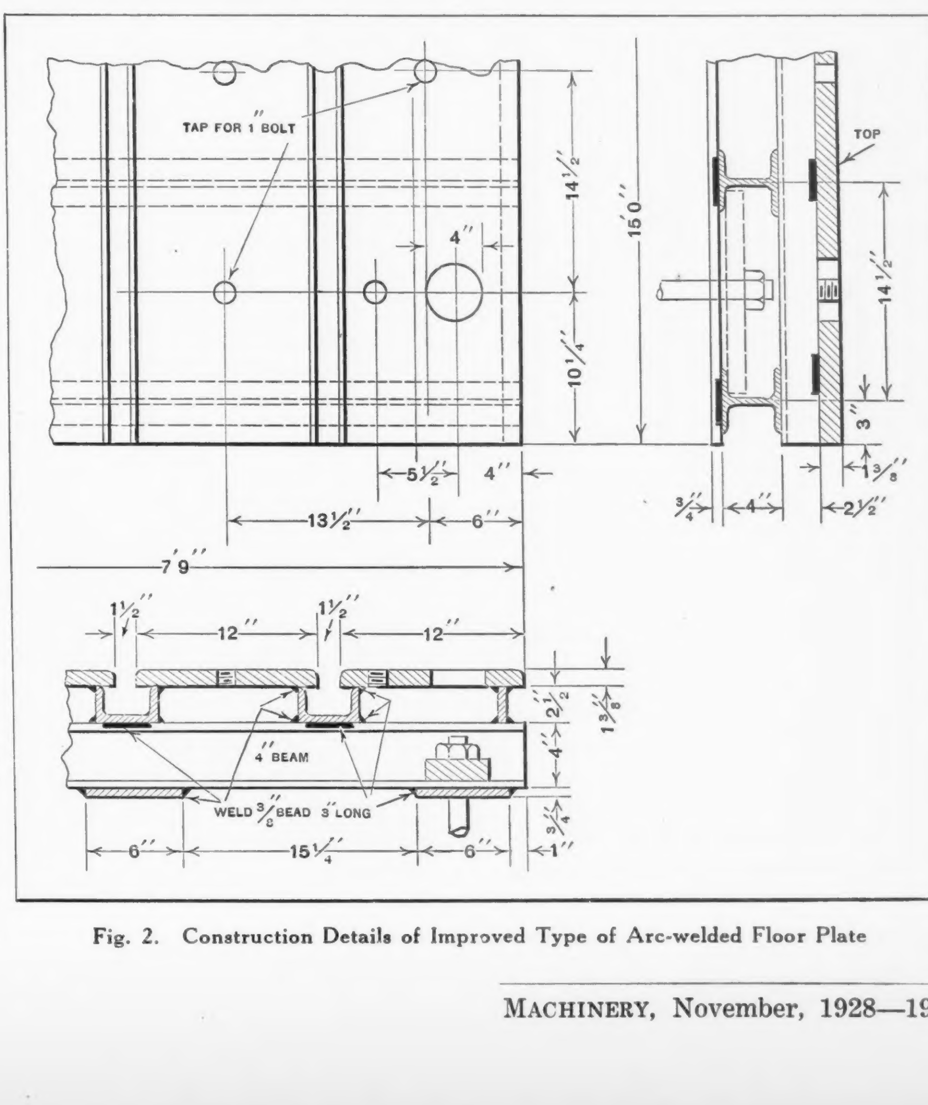


Fig. 2. Construction Details of Improved Type of Arc-welded Floor Plate

Time-saving Operations on Pistons and Connecting-rods

By CHARLES O. HERB

METHODS of manufacture that will give the highest possible rates of production without sacrifice of accuracy are the constant aim of most automotive production engineers. The present article describes a number of operations that have effected economies at the Racine, Wis., plant of the Nash Motors Co. These examples were selected in the piston and connecting-rod departments.

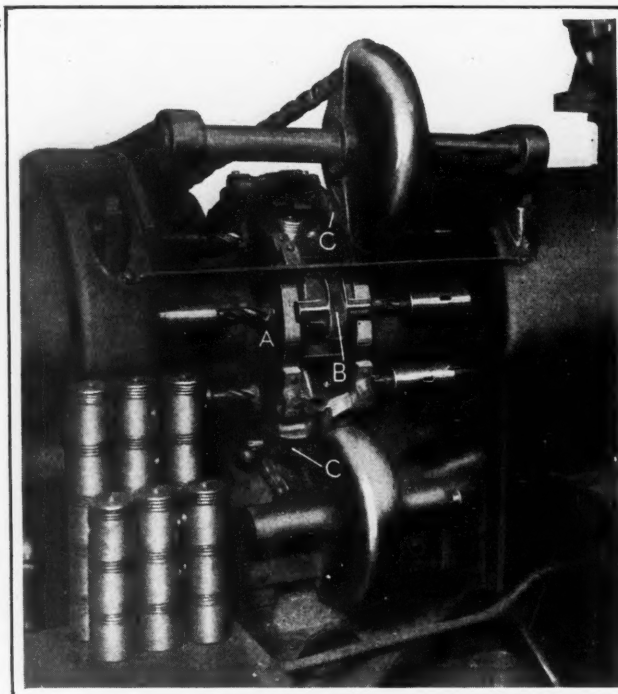


Fig. 1. Drilling Both Piston-pin Holes in a Machine Equipped with Continuously Revolving Work-carrier and Spindle Housings

Drilling Piston-pin Holes in a Continuous Operation

In drilling the piston-pin holes of "Bohnalite" pistons, a production of 300 parts per hour is obtained with the Davis & Thompson continuous multiple-spindle machine shown in Fig. 1. The piston-pin holes are drilled to a diameter of 49/64 inch through metal about 3/4 inch thick on each side. The operator places the pistons on jigs located between two flanges of work-carrier *A*. Each of these jigs remains in the same relation with two opposing drill spindles, as the work-carrier and the spindle housings rotate in synchronism. Both flanges contain bushings for accurately guiding the drills into the pistons.

When a piston is placed in any jig which happens to be in the loading position at the front of the machine, both corresponding drill spindles are withdrawn. Before positioning a piston, the overhead hinged shoe *B* is swiveled on its bearings by the operator to facilitate placing the piston in the jig. The shoe is then allowed to drop down again on top of the piston. Accurate height location of each piston is assured by seating the skirt end on a hardened and ground plate of the jig. A plug registers between the internal bosses of the pistons to insure their proper radial location.

When each piston reaches the top of the machine, as the work-carrier and spindle housings revolve, a steel chain *C* clamps the corresponding shoe *B* firmly on the piston for the operation and maintains this clamping action until the piston again reaches the front of the machine. Immediately, when the piston is clamped, both corresponding drill spindles are fed into the work by the action of cams. The drills feed in gradually during the cutting, and rapidly withdraw when the operation is finished.

Drilling the Oil-holes in Pistons

Two special Kingsbury drilling machines of the construction shown in Fig. 2 are used for drilling oil-holes around two grooves in the pistons. One machine drills twelve holes around the third groove from the closed end, while the other machine drills a similar number of holes around the fourth groove. In each machine, the skirt end of the piston rests on four vertical pins, and the part is located radially by means of a vertical plug at the center of the fixture, which comes in contact with the two internal piston bosses.

The work-table indexes automatically and the drill head reciprocates in synchronism with it. Each time that the drill spindle moves forward, slide *A* also advances to clamp the piston between it and block *B* during the operation. Slides *A* contain bushings to guide the drills. One man tends both machines and obtains a production of 230 pistons per hour from each machine.

Facing Connecting-rods and their Caps

Both sides of the connecting-rod crankpin bearings, or of the connecting-rod caps, are faced simultaneously and the bore chamfered in the "Natco" two-spindle machine shown in Fig. 3. This illustration shows the operation being performed on a rod. The previously sawed crankpin end is seated on surfaces of block *A*, the bolt holes in the connecting-rod being slipped over two dowel-pins *D*, Fig. 4, which project from this block. After a rod has been placed on the block in this manner, valve *B*, Fig. 3, is operated to admit air into a "Logan" pneumatic cylinder *F* at the back of the machine. As the air acts on the piston of this cylinder, clamps *C* are operated, gripping the connecting-rod firmly for the operation. These clamps come in contact with the finished surfaces around the bolt holes. A toggle *E*, Fig. 4, connects the shanks of the two clamps to the piston-rod of the air cylinder.

After the connecting-rod has been clamped, the operator moves a control lever, which causes both

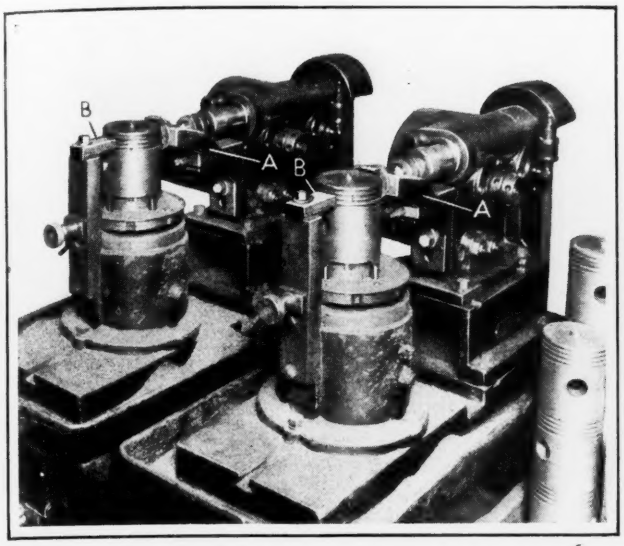


Fig. 2. Machines Employed in Drilling the Oil-holes around the Piston Grooves

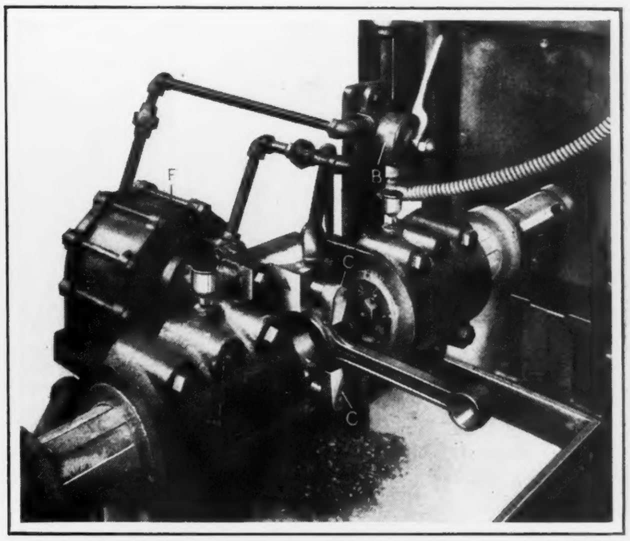


Fig. 3. Facing and Chamfering Both Sides of Connecting-rods and their Caps

tool-spindles to advance toward the work in unison, and when the operation has been performed, the spindles automatically recede to the positions shown. The housings in which the tool-spindles are carried are operated to and fro hydraulically. Both tool-spindles are equipped with large-diameter pilots which enter bushings close to the work to steady the tools during the cutting.

One operator tends two of these machines and obtains a production of 300 pieces per hour on each machine. Bearing caps are handled in the same manner as the connecting-rods without requiring any changes in the machine equipment.

Drilling a Hole the Full Length of Connecting-rod Arms

For delivering oil from the crankpin bearing of connecting-rods to the piston-pin bearing, a small-diameter hole is drilled the full length of the arm. The length of this hole in the arm itself is approximately 6 3/4 inches, and as the rod is made from S. A. E. 1040 steel and has a scleroscope hardness of between 40 and 45, a high rate of production is not to be expected in this operation. However, the output has been materially increased by first drilling a 5/16-inch hole to a depth of 5 inches in a Pratt & Whitney gun drilling machine, such as shown in Fig. 5, and then drilling a 1/4-inch hole from the opposite end of the connecting-rod through the piston-pin boss and the arm until the previously drilled hole is reached. This second drilling operation is performed in two steps on the multiple-spindle machine shown in Fig. 7.

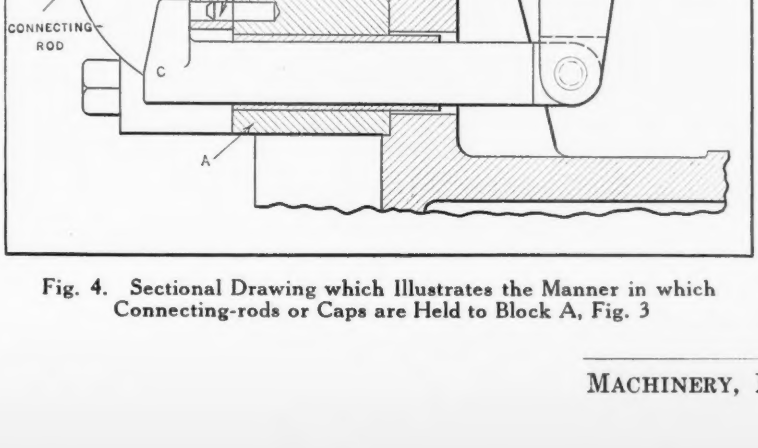


Fig. 4. Sectional Drawing which Illustrates the Manner in which Connecting-rods or Caps are Held to Block A, Fig. 3

Each gun drilling machine is of duplex design and is equipped with two motors, to permit drilling two connecting-rods simultaneously. The drills are hollow, consisting of tubes with a single-flute drill bit brazed on one end. In operation, the connecting-rod is revolved and the drill fed slowly into it, oil being forced through the hollow drill under a high pressure to wash all chips back along the flute.

The connecting-rods are driven from the small end, the piston-pin bearing being seated on a plug of the headstock chuck and then clamped in place. The crankpin-bearing end of each rod is located on the tailstock chuck by seating both bolt holes over dowel-pins. Fourteen connecting-rods are turned out per hour with each duplex machine.

The machine illustrated in Fig. 7 has two groups of eight drill spindles each, and is equipped with a three-station jig. Each connecting-rod is mounted on the fixture with the small end uppermost. The piston-pin bearing is slipped over a plug of a block *A* and two connecting-rods are clamped in place as the corresponding clamp *B* is swung downward into place. When loading connecting-rods, this clamp is in the raised position shown at *C*. Each connecting-rod arm is held in the proper vertical position by means of a slotted block, such as seen at *D*.

When the work-table is indexed into the first working position, holes are drilled into eight rods about one-half the distance to the previously drilled holes. Then in the second indexed position, drills enter the same holes and are fed until the 5/16-inch holes are reached. Bushings guide the drills in the first step, but in the second step the

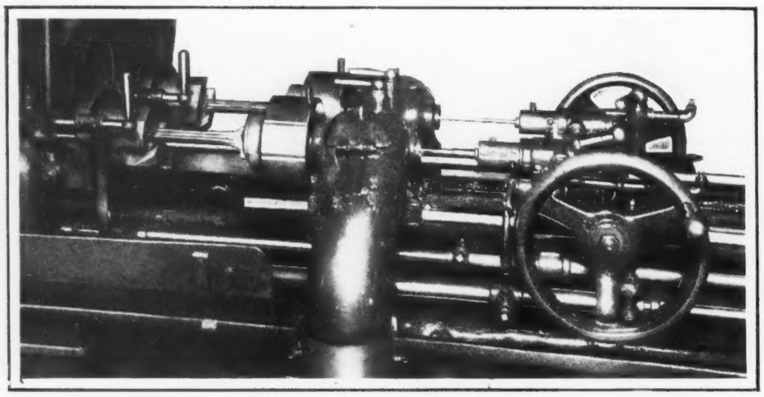


Fig. 5. Typical Gun Drilling Machine Used for Drilling a Small-diameter Hole through the Arm of Connecting-rods

holes themselves are used as pilots. The production in this operation averages 150 connecting-rods per hour.

Assembling Pistons, Piston-pins, and Connecting-rods

Pneumatic equipment has effected large savings over the time formerly consumed in making piston, piston-pin, and connecting-rod assemblies. One of the pneumatic units employed is illustrated in Figs. 6 and 8. Each unit permits an average of three assemblies per minute and eliminates one man. The piston comes to this fixture at a temperature of from 110 to 125 degrees F. In this fixture there is installed a heating unit which maintains the required temperature of the piston so as to permit accurate assembly. This heating unit is not shown in Fig. 8.

In using any of these units, the piston is first inserted into a ground sleeve *A*, Fig. 8, until its closed end rests on the head of adjusting screw *B*. The piston is next swiveled in the sleeve until bar *C* can be entered into one of the piston-pin holes by pushing against the handwheel seen in Fig. 6. Next the connecting-rod is entered between the internal bosses of the piston, as seen at *D* in Fig. 8, and rod *C* is entered all the way into the bearing of the connecting-rod and into the opposite hole in the piston so as to accurately align the piston and connecting-rod.

The piston-pin to be assembled is then laid on vees in the housing, the tops of which may be seen at *E*, Fig. 6. The slot in one end of the piston-pin is slipped over tongue *F*, Fig. 8, which is fastened to the end of an air-actuated plunger *G*. This serves to so align the piston-pin that when it is assembled, the hole provided in the pin for the locking screw will coincide with the tapped lock-screw hole in the piston boss.

After the piston-pin has been positioned as outlined, the operator turns the handle of valve *H*, Fig. 6, to admit air into the rear end of cylinder *J*. This causes plunger *G*, Fig. 8, to move forward under pressure and force the piston-pin into both piston holes and through the connecting-rod bearing, as illustrated at *K*. After this assembly has been made, the connecting-rod, piston-pin, and piston are withdrawn as a unit from sleeve *A*. The handle of valve *H*, Fig. 6, is reversed to admit air into the front end of cylinder *J*

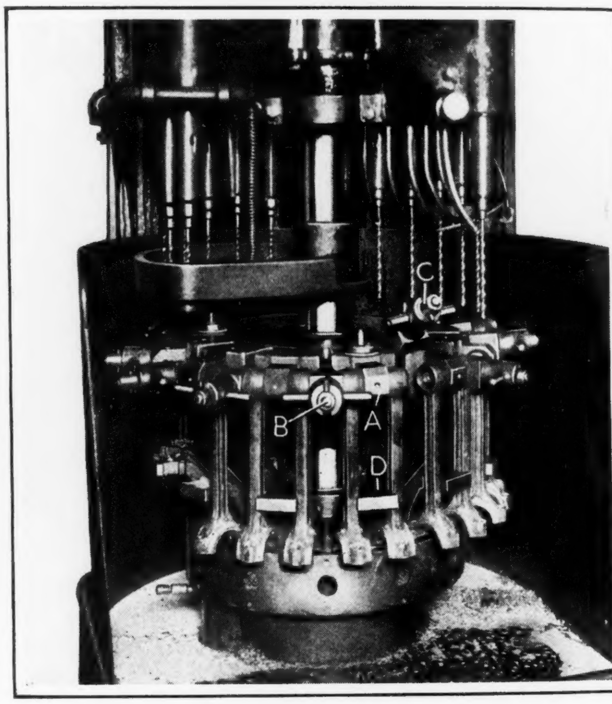


Fig. 7. Multiple-spindle Operation which has Materially Reduced the Time of Drilling the Hole through Connecting-rod Arms

for withdrawing the plunger that pushes the piston-pin into place. The piston-pin is a press fit in both holes of the piston and a slip fit in the connecting-rod bearing. A key controls the in and out positions of bar *C*.

* * *

Few words in our language are more abused than the word "theory" and its derivatives. Utterance of the word too often brings to mind an academic individual sitting in a chair far from the practical world and dictating from out of his own mind the significance of anything and everything. In the true sense of the word, this man is a dreamer rather than a theorist. True theorists are practical men of the highest order. Galileo, Newton, Diesel, and Steinmetz are examples; and such men as these have laid the foundation of modern engineering.

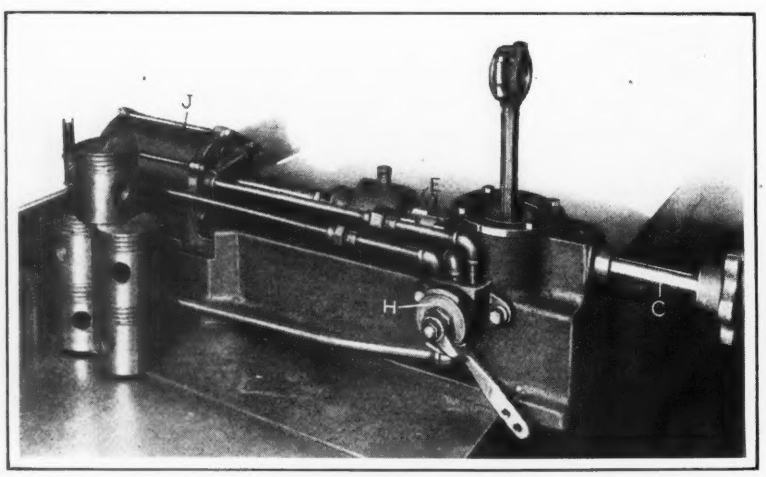


Fig. 6. Pneumatic Equipment which has Effected a Large Saving in Time in Assembling Pistons, Piston-pins, and Connecting-rods

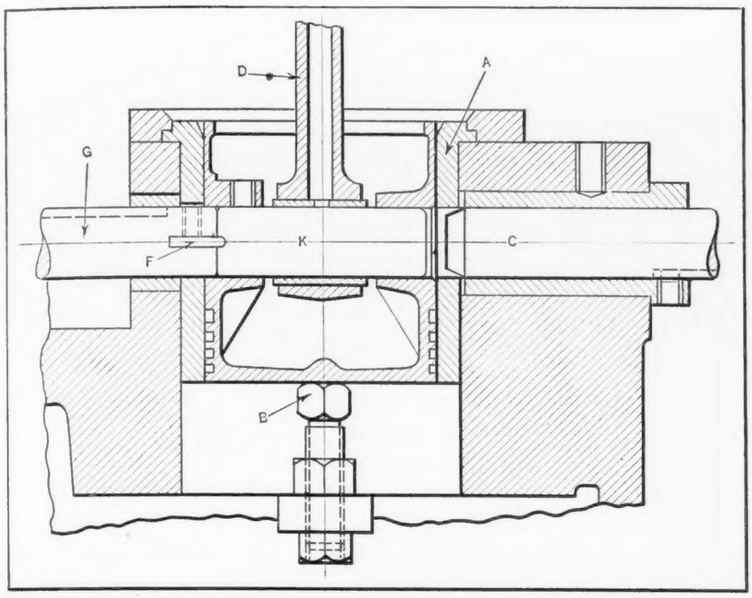


Fig. 8. Sectional View which Illustrates the Manner in which Piston-pins are Assembled by Air

MEETING OF THE AMERICAN WELDING SOCIETY

The American Welding Society held its fall meeting, with headquarters at Bellevue-Stratford Hotel, Philadelphia, Pa., October 8 to 12, simultaneously with the exposition at the Commercial Museum held under the auspices of the American Society for Steel Treating. Among the papers that were read at the meeting may be mentioned "Welding in the Heating, Ventilating, and Plumbing Industry," by R. A. Jack, of *Domestic Engineering;* "Testing Joints for Aircraft Structures Prepared Under Procedure Specifications," by H. L. Whittemore, Bureau of Standards, and H. H. Moss, Linde Air Products Co.; "Welds at Elevated Temperatures," by Professor C. Moser, Leland Stanford University; "Formula for Computing Design Stresses for Pressure Vessels," by S. W. Miller, Union Carbide and Carbon Research Laboratories; "Running a Successful Job Welding Plant," by J. S. Oechsle, president, Metalweld, Inc.; "Design of Welded Structures," by F. P. McKibben, consulting engineer, General Electric Co.; "Erecting a Building by Welding," by J. F. Lincoln, Lincoln Electric Co.; "Oxy-acetylene Cutting in the Structural Field," by H. E. Rockefeller, Linde Air Products Co.; and "Design of Machinery Parts by Use of Welding of Steel Shapes," by Messrs. Hague, Marthens, and Brinton, Westinghouse Electric & Mfg. Co.

Further information regarding the papers may be obtained from the American Welding Society, 33 W. 39th St., New York City.

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INDEX TO MACHINERY

The index to the thirty-fourth volume of MACHINERY (September, 1927, to August, 1928, inclusive) is ready for distribution. Copies will be sent to subscribers upon request.

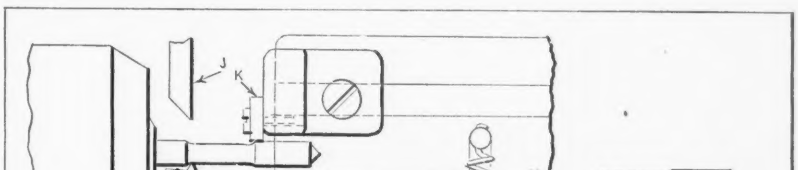
PIVOTED TOOL-HOLDER FOR AUTOMATIC SCREW MACHINE

By HENRY H. KNABE

The tool-holder shown in the accompanying illustration was made to turn the drill rod piece *W*. It was mounted on the tool-carrying slide of a standard make automatic screw machine that has no turret tool-holder. The piece to be turned has a male center at one end and a turned shank at the other. The rest of the piece is left full size, but the male center, turned shank, and body of the piece must run concentrically.

In a former method of producing this piece, the shank was turned with a wide forming tool which required frequent resetting, as the stock was light and the chattering of the tool caused it to move, so that many times the cutting edge would chip. Turned in this way, many rejections resulted, because the shank did not run true with the body, and the wear on the machine was considerable. The male center even then was only roughed out and had to be finished on a hand screw machine.

With the tool shown in the illustration, accurate finished blanks were secured and the tool required very little attention after setting. Cam *A* is carried on a cross-slide which feeds in as the tool-slide starts forward. Cam follower *C*, striking cam *A*, causes tool *B* to be fed in to the work. Cam *A* stays in position while the turning tool is fed forward until the length of the shank is turned. It is then withdrawn, allowing tool *B* to be pulled out of contact with the work by the spring *H*, connected to an extension rod of tool-holder *E*, which is pivoted at *F*. A set-screw *G* limits the backward movement of the tool. The cut-off tool *J* is then fed in and cuts off the blank, at the same time forming the male center of the next blank. The work is supported by the follow-rest rollers *K*, also mounted on the tool-slide, during the turning operation.



Tool-holder Used in Machining Small Concentric Work

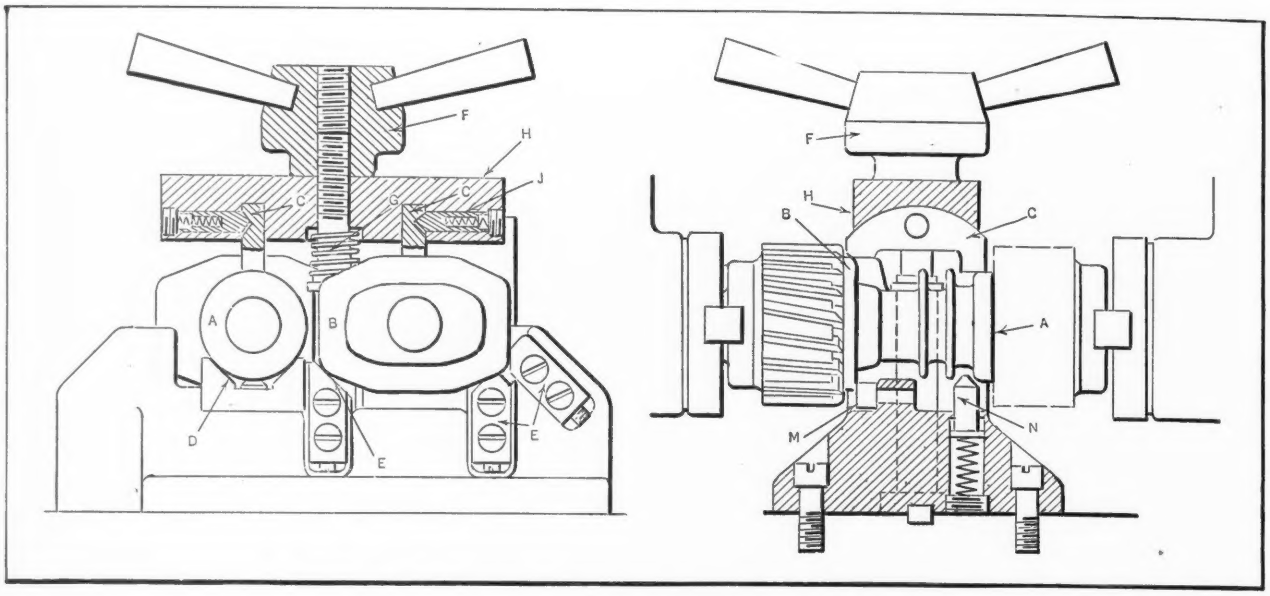


Fig. 1. Fixture for Milling Refrigerator Cylinders

Milling Electrical Refrigerator Cylinders and Crankcases

By HOWARD ROWLAND

THE tooling equipment here illustrated has made possible high production rates in milling electrical refrigerator parts. The fixture for holding refrigerator cylinders for milling the two parallel faces *A* and *B*, Fig. 1, was designed to hold the cylinder casting so that one cylinder head face and one crankcase face would be on each side. In this way, it was possible to place the cylinder castings close together, to equalize the work of the milling cutters and effectually cut down the table travel for each cut.

The cylinder castings are located in the fixtures by V-block *D* and angle support pieces *E*, on which the flanges of the cylinders rest. Pins *M* and *N* provide lateral location. In strap *H* are mounted two rocker clamps *C*, arranged so that there will be an equal pressure on both ends of the two cylinders in the fixture when the clamping nut *F* is tightened. When the clamping nut is released, spring *G* raises the strap *H* away from the cylinder castings to facilitate reloading the fixture. When strap *H* is raised, the rocker clamps are prevented from dropping out of their slots by pins *J* which, in turn, are held in place under spring tension.

Two of these fixtures are mounted close together on an index base, Fig. 2, so that one fixture can be reloaded while the milling operation is being performed on the work in the other fixture. The operation of the machine is almost entirely automatic. When the feed is thrown in, the table rapidly advances and automatically feeds the work between the stellite inserted-blade cutters. When the full surface is milled, a dog automatically trips the rapid traverse lever, and the table automatically returns. When the table is withdrawn a sufficient distance from the cutter, it automatically

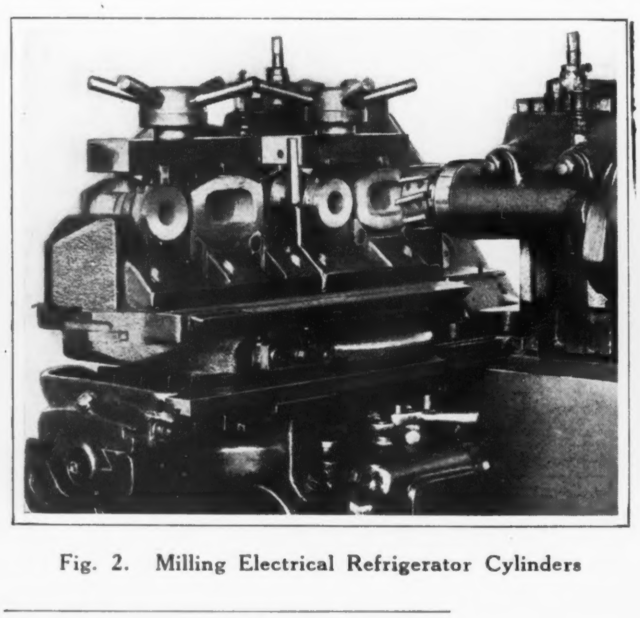


Fig. 2. Milling Electrical Refrigerator Cylinders

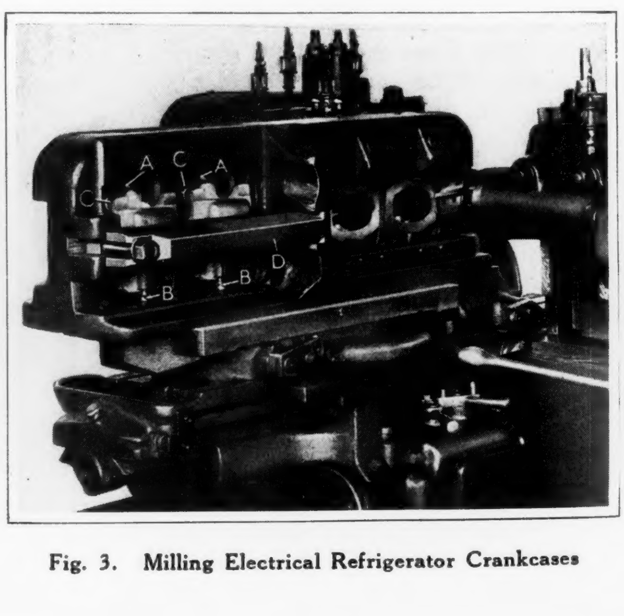


Fig. 3. Milling Electrical Refrigerator Crankcases

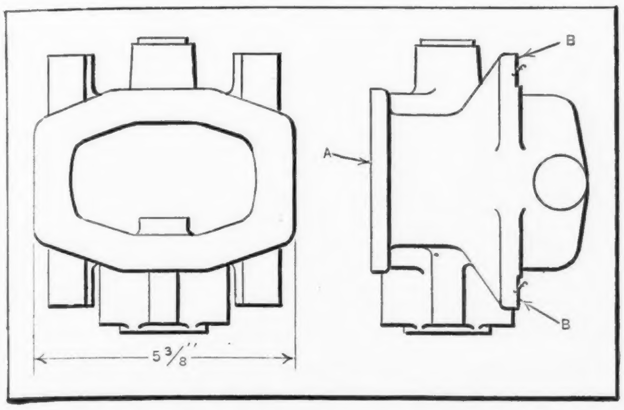


Fig. 4. Electrical Refrigerator Crankcase Milled with Equipment Shown in Fig. 3

reverses and the index table is automatically indexed through 180 degrees, completing the cycle. The position of the operator is the same throughout the cycle of operations. Practically his only duty is to unload and load the fixtures.

Milling Refrigerator Crankcases

The refrigerator crankcase shown in Fig. 4 has three surfaces to be milled—the elliptical face *A* which is seated against the refrigerator cylinder, and the four bolt boss surfaces *B*, which are in the same plane.

The fixture for holding the crankcases for milling these surfaces was constructed, as shown in Fig. 3, so that the elliptical surface would protrude through the fixture, and the work was clamped so that the bolt boss surfaces were accessible to the milling cutters on the other side of the fixture.

Two crankcases are held in a fixture. They are located by the vees *A* and the fixed pointed supports *B*. The thickness of the bolt bosses is equalized by pins *C*, only two of which are visible in the illustration. The hinged clamp *D* clamps two cases at a time through an equalizing foot.

Two fixtures are mounted close together on an index base. The index base is mounted on a duplex miller which has one spindle with a stellite inserted-blade milling cutter, as shown, on one side, for milling the elliptical surface, and two spindles with the same type of cutters on the other side, for milling the bolt boss surfaces. The operation of the machine is identical with that described for the milling of the cylinders. Production was at the rate of eighty per hour. The operator's main duty was the unloading and loading of the fixtures.

* * *

ITALY'S MACHINERY IMPORTS DECLINED LAST YEAR

In 1927, the United States, which supplies only 12 per cent of the machinery imported into Italy, lost 41 per cent in value of exports as compared with 1926, and 37 per cent as compared with 1925. Imports entering Italy under the classification "Machinery, apparatus, and parts" (including industrial machinery, agricultural machinery, sewing machines, electrical machinery, and typewriters) amounted to $35,637,000 in 1927.

SPRING BACKING PLATE FOR CHUCK

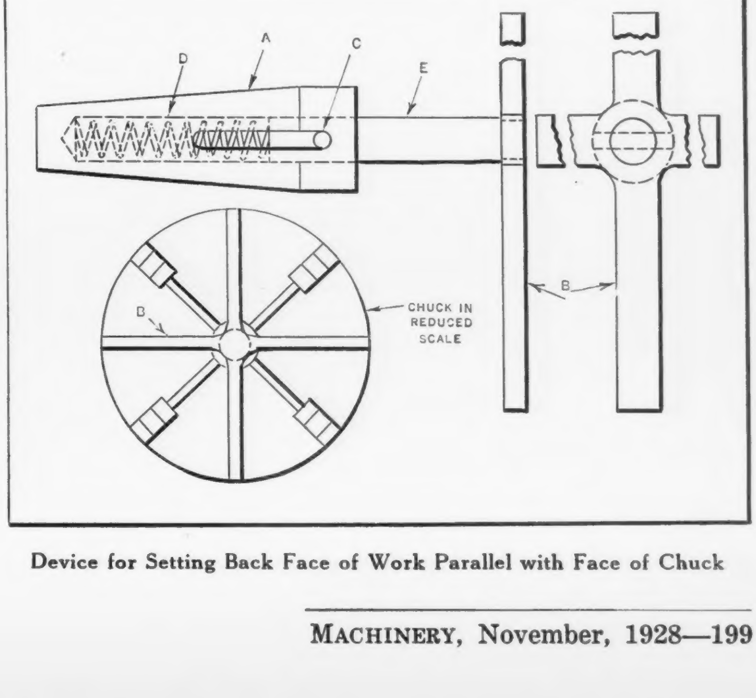
By H. MOORE

When turning plain disk-shaped die pads or similar work, it is the usual practice to face one side and as much of the periphery as possible without interfering with the chuck jaws, and then turn the piece around in the chuck, true it up, and finish the opposite face and the remainder of the periphery. The most difficult part of the operation is to relocate the work so that the finished back face is parallel with the lathe faceplate. The jaws interfere with the view of the work, and most mechanics use blocks or calipers for gaging the distance from the face of the chuck to the face of the work.

Having a lot of die pads ranging from 9 inches in diameter by 1 1/2 inches thick to 20 inches in diameter by 3 1/2 inches thick, the writer made the spring backing plate shown in the illustration for locating the finished face of the work parallel with the chuck face or at right angles with the spindle, as required for finishing the remaining side parallel with the first. The bushing plate *B* is held on a tapered body *A*, which fits into the headstock spindle. The plate *B* on which the work is located, has four arms cut from a flat plate, and is riveted to the end of the sliding rod *E*. A pin *C* in rod *E* slides in a slot on one side of body *A* and serves to keep the assembly together.

A spring *D* normally holds the plate in the position shown. Care is taken to have the face of plate *B* even with the outer face of the chuck jaws when in its normal position. When the work is placed in the chuck and forced back to whatever depth is necessary, the plate recedes, compressing the spring *D*, which keeps the arms *B* in close contact with the finished face of the work. By revolving the lathe spindle by hand, it can be seen if all four arms *B* are in contact with the face. If they are not, the work can be readily brought into alignment.

The advantage of the spring plate over a solid one is that it serves as a truing device for work gripped in the jaws at any distance from the chuck face. Also, the plate is not disturbed if the work is tapped back against it, for it will spring back and immediately regain its former position and indicate the accuracy of the setting.



Device for Setting Back Face of Work Parallel with Face of Chuck

COINING AUTOMOBILE PARTS

In the construction of automobiles, there are many small parts such as links, levers, shifter forks, etc., having bosses that must be true in thickness and parallel within a few thousandths of an inch, but that do not require machining with a cutting tool. At the Racine, Wis., plant of the Nash Motors Co., it is the practice to run such parts through coining presses. Parts can easily be coined to specified thicknesses within limits of plus or minus 0.003 inch. Presses of 600 tons capacity are used. The success of a coining operation depends largely on holding to a minimum the amount of stock to be coined down. At the Nash plant, not over 1/32 inch of stock is allowed for this operation. An excessive amount of stock not only tends to widen variations in the thickness of the piece coined, but also has a destructive effect on the structure of the material.

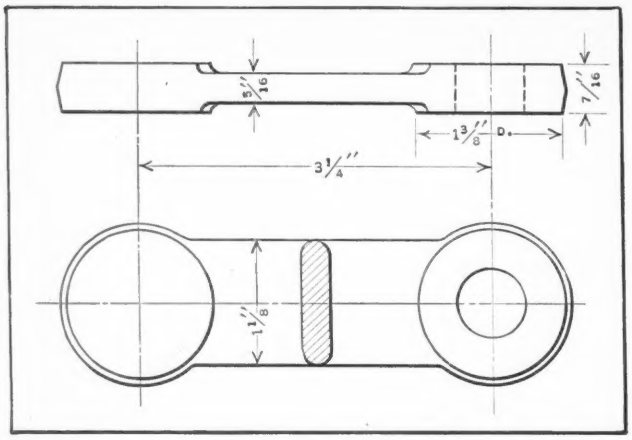


Fig. 1. Steel Spring Shackle with Both Ends Coined

Fig. 1 shows a spring shackle, both ends of which are coined to a thickness of 7/16 inch within plus or minus 0.003 inch. The production averages 450 pieces per hour. Both the top and bottom dies employed for parts of this nature are flat, and can be repeatedly ground as they become worn.

A somewhat more complicated part run through coining presses is illustrated in Fig. 2. This is a malleable iron bracket for a parking brake lever. It has five bosses which must be parallel with each other and of a thickness within plus or minus 0.004 inch. Only one of these bosses requires coining on both ends, but actually five spots are coined on each side, as the part must be well supported on both sides for the operation. A production of 300 brackets per hour is maintained.

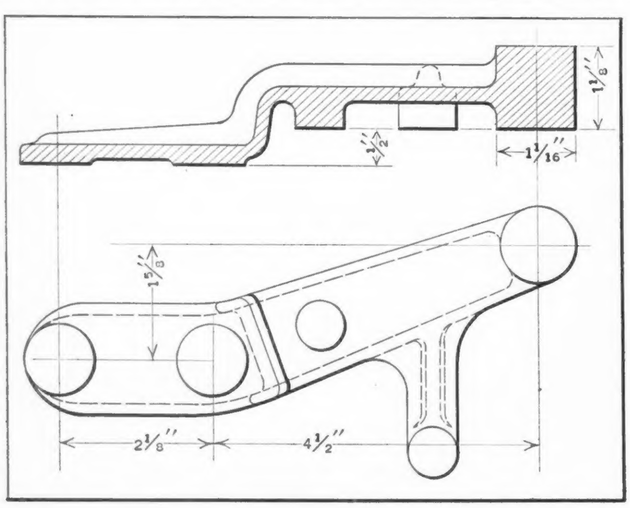


Fig. 2. Bracket Having Five Bosses Produced Parallel and to Specified Dimensions in a Coining Press

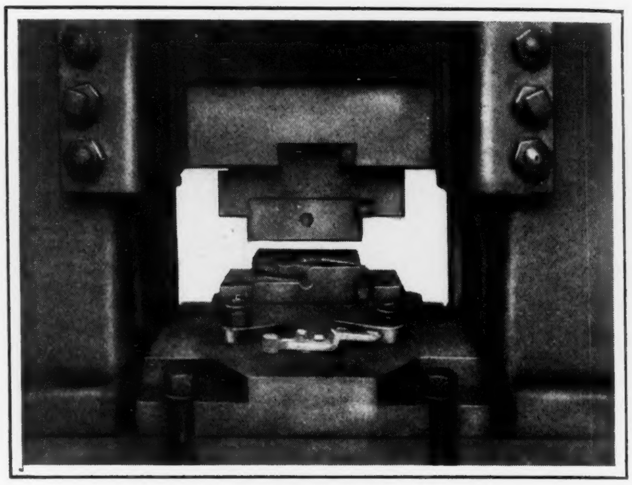


Fig. 3. Dies Employed in Coining the Bracket Shown in Fig. 2

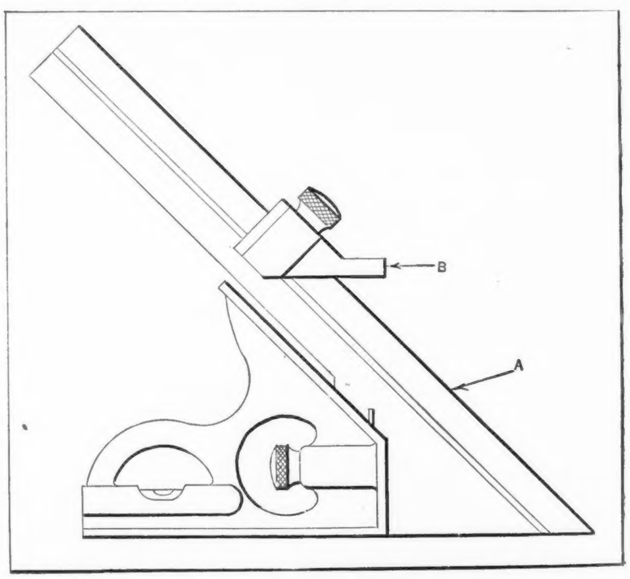
Dies shaped to suit the part must, of course, be employed for this operation. From Fig. 3 the construction of the bottom die can be observed. An example of the work lies in front of the bottom die-holder.

* * *

GAGE FOR SETTING PLANER TOOLS

By C. W. PUTNAM

A gage that has considerable range in setting planer or shaper tools to given heights above locating points can be readily made by adapting a special blade to a standard combination square head. Blade *A* is grooved to fit the head and is cut on a 45-degree angle. Parallel to the edge is a groove used in clamping the sliding member *B* at the desired height. The upper surface of the projecting arm of *B* is parallel to the base of the square head. The required height of this surface from the base is established by means of a micrometer caliper or a height gage, and when set, the planer or shaper tool is adjusted to that surface.



Combination Square Head with Special Blade and Rider for Gaging Height of Planer or Shaper Tools

Letters on Practical Subjects

DIAL INDICATING GAGES

The two dial indicating gages shown in Figs. 1 and 2 are used for testing the brass casting shown in dot-and-dash lines, which is machined to the finish marks indicated. A turret lathe with special equipment is used to turn the ball seat *Z*, the sweep *Y*, the angular cut *X*, and the face and groove *W*. The casting thus finished forms part of the disk chamber of a water measuring device, and is held to close limits.

The gage shown in Fig. 1 is for indicating the depth and contour of the ball seat *Z* in relation to the finished groove *X*, as well as the radius of the sweep *Y*. On the vertical face of the base casting *A* is screwed and doweled the hardened and ground locating plate *B*, which is a loose fit in the groove *W* of the casting to be tested. A ball *C*, hardened and ground, is retained in a central counterbore in plate *B*, as shown.

As the finished casting is placed over the plate *B*, the face of groove *W* strikes the face of this plate, while the ball *C* enters the ball seat, the radius of these being the same, and is pushed back until the work casting is at rest, locating itself on the three hardened and ground points *N*, which are so placed as to fit the sweep *Y*. The shank of ball *C* communicates this motion to the bellcrank *F* which is under pressure exerted by spring *G*, and which pivots on pin *H* in a lug on casting *A*. This bellcrank, in turn, presses against the spindle end *K* of the dial gage *L*, which is screwed and doweled to a lug on the base casting.

Meanwhile the work casting, on being located over the three points *N* on its sweep *Y*, disturbs one of these points, which is mounted on the lever *Q*. This third point consists of the hardened ball *R* held in the lever *Q* by the screw *S*. When this point is moved, motion is communicated through the bellcrank *T* against the pressure from spring *U* to the spindle *V* of the second dial *M*, which is also mounted on a lug on the base casting. It will be noted that the dial gages are fastened to lugs cast on the base at such an angle as to avoid interference between the motion trains of the dials. A

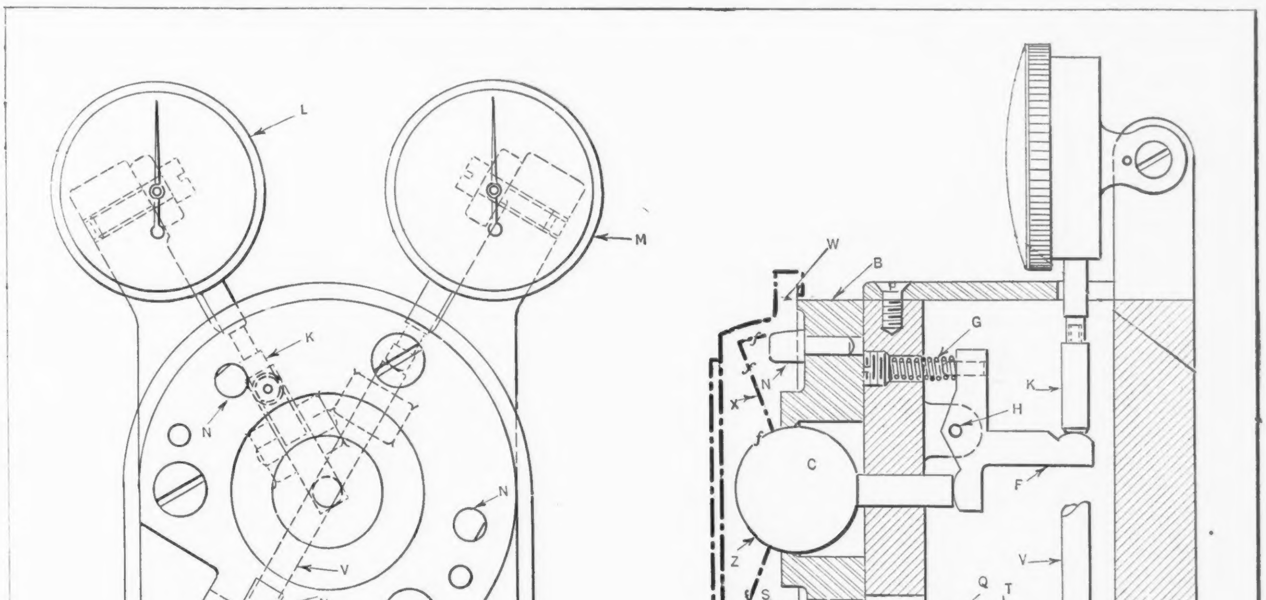


Fig. 1. Dial Gage for Machined Surfaces on Brass Casting

steel master part like the brass ones to be tested is first made up to correct dimensions and used for setting up the gage and for checking it.

The second dial gage, shown in Fig. 2, is for testing the angular face X to determine whether the angle and the depth are in proper relationship to the finished face W. This is done by means of two dials, indicating at two points. The piece to be tested is placed over the hardened and ground plate A, which is screwed and doweled to the vertical face of the casting B. The groove W is a close fit over the shoulder J. When the casting is placed over this plate, the two hardened pins C strike the angular face X. Pins C, which are at right angles with the face X, are forced back, moving the bellcranks D which pivot on pins E set in lugs on the base casting. These bellcranks are thus moved against the pressure of the springs F, imparting motion to the spindles G of the dial gages H. These gages are fastened to properly placed lugs on the casting B. Of course, the same steel master used in setting up and testing the dial gage shown in Fig. 1 is used in setting up and checking the second gage. The part being tested can be revolved so that it will be gaged or tested all over.

New York City B. J. STERN

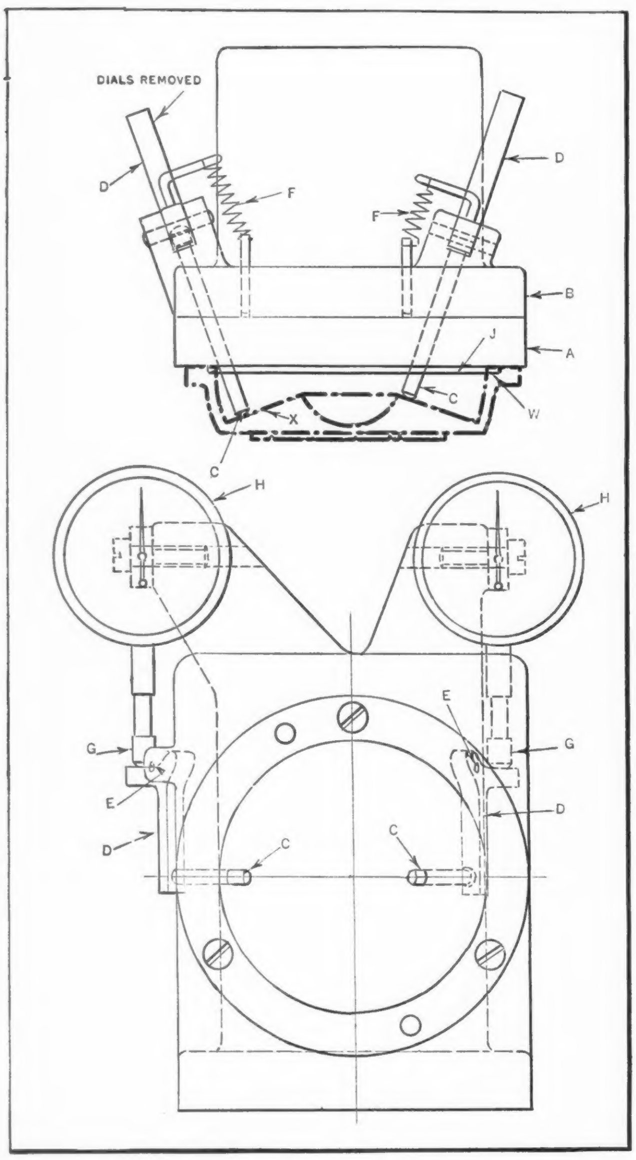
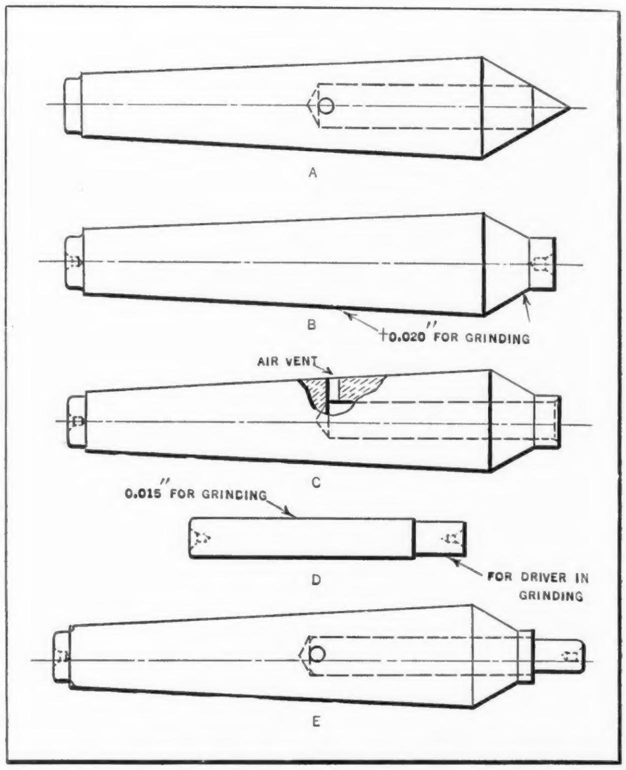


Fig. 2. Gage for Testing Angle and Position of Machined Surface



Center with Steel Insert, and Views Showing Steps in its Production

CENTERS WITH HARDENED INSERTS

Centers for lathes and grinding machines, like the one shown at A in the accompanying illustration, have been used by the writer for several years. These centers give excellent service and are comparatively inexpensive to make. As they have no projecting ends, they are practically as strong as though made of one solid piece.

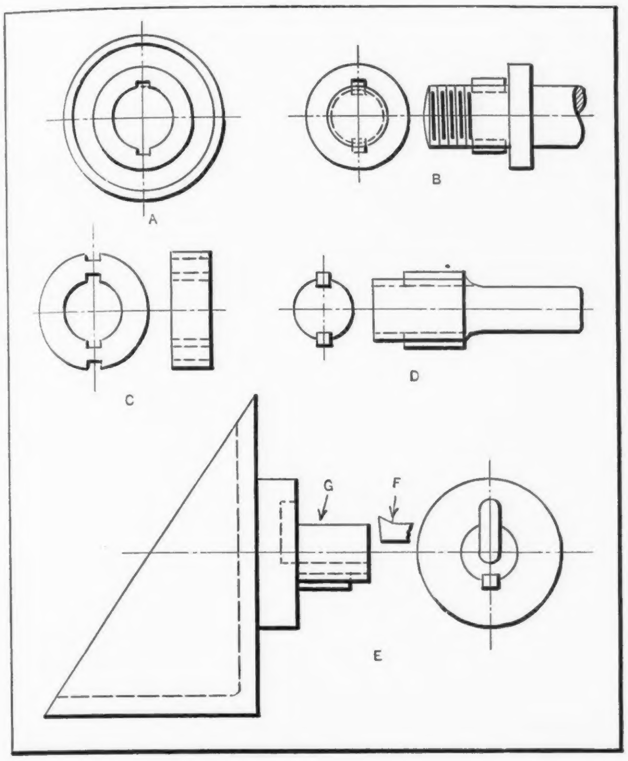
The first step in making these centers is to rough-turn the body from cold-rolled or machine steel, as shown at B, allowing about 0.020 inch for finish-grinding. The body is next carburized to a depth of about 1/16 inch, after which the hole for the steel insert is drilled and reamed, and the small hole or air vent drilled, as shown at C. The body is then hardened, and the hardened high-speed steel insert D ground to a tight press fit in the reamed hole.

A little oil, or white lead and oil, is used on the insert to prevent "freezing" when assembling the center and insert. The assembly E is placed between centers on a grinder and the taper ground in the usual way, following which the point is ground, thus completing the center, as shown at A. The small air vent hole also serves to distinguish this center from the ordinary solid carbon steel center.

Berkshire Heights, Pa. GUSTAV KOPSCH

CUTTING DOUBLE KEYWAYS IN GEARS

Recently the writer was given the job of cutting double keyways in 120 gears which form part of the equipment of gear-cutting machines. The double keyways, as shown at A in the accompanying illustration, were to take the place of pins formerly employed to secure the gears to the machine shaft. The gears were of different sizes, but all had 1 1/2-inch diameter holes which fitted the ma-



(A) Gear with Double Keyways; (B) Shaft for Gear A; (C) Ring Gage; (D) Plug Gage for Double Keyways; (E) Angle-plate with Stud for Holding Gear while Cutting Keyways

chine shaft shown at *B*. It was also necessary to fit this shaft with double keys to match the keyways in the gears, which were required to be reversible as well as interchangeable on the shaft.

The first step was to turn up the plug gage shown at *D*, cut the two keyways in a milling machine using a dividing head, and fit the two keys. Next the ring gage shown at *C* was made to fit over the plug gage *D*. The shaft shown at *B* was then placed in a milling machine and the two keyways cut with an end-mill to fit the keyways in the ring gage. The ring gage *C* was next placed over the shaft *B*, with the keys in place, and the two keyways cut on the outside of the ring gage for use later in setting the shaper tool for cutting the keyways in the gears.

The angle-plate shown at *E* was attached to the platen of a shaper. To the face of the angle-plate was attached the fixture or stud arbor *G* for supporting the gears while cutting the double keyways. It will be noted that a clearance is machined in the upper side of the stud for the tool *F*, and a key is fitted in the lower side. The ring gage *C* was employed for setting the tool *F* preparatory to cutting the first keyway in the gear. The key in the lower side of the stud was not used, of course, when cutting the first keyway. After finishing the first keyway, the gear was revolved one-half revolution and the key inserted, thus locating the work in the proper position for cutting the second keyway. C-clamps were employed for holding the gears in place.

Erie, Pa. JOHN A. BOOSER

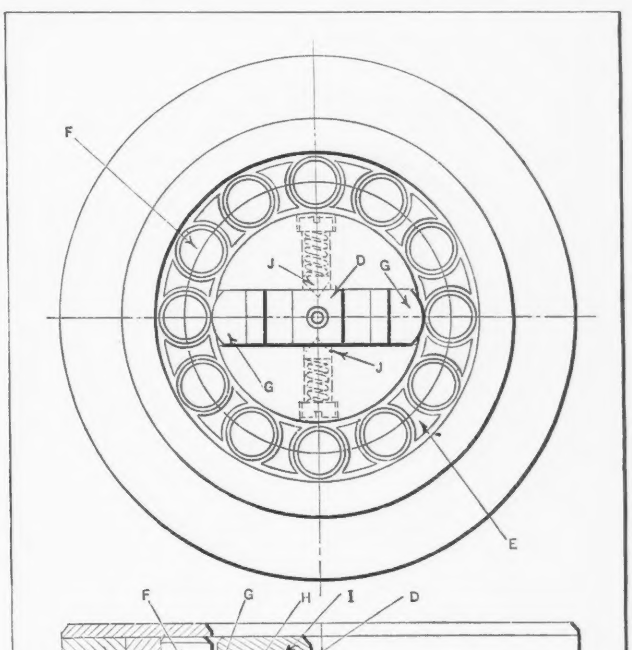
SWAGING DIE FOR WIRE AND TUBING

The rotary swaging die here illustrated was designed for reducing the diameter of gold spectacle temples at the point where they curve around the ear. The material for the temples comes in reels of straight wire or specially made wire having a straight wire core around which is wound fine gold wire. This wire is cut to the required lengths, and each length is fed into the rotary die which swages one end to the required diameter. A variety of different cylindrical forms can be produced by employing formed swaging dies.

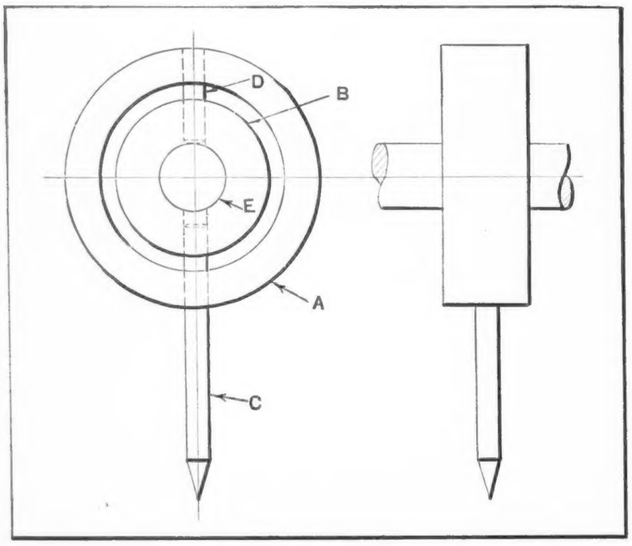
The type of swaging die shown in the illustration leaves no marks or lines on the work and is well adapted for reducing the diameter of wire or small tubing that has been plated. The die consists of a stationary housing *A* which is securely fastened to a machine base. Within the housing runs a spindle *B*. The hardened ring *C* is pressed into housing *A*. The rollers *F* come in contact with the hardened ring when they strike the backing blocks *G*. The roller cage *E*, which is milled out to receive the required number of rollers *F*, is securely fastened to the housing. A slot is milled across the end of the revolving spindle *B* in which the backing blocks *G*, wedges *H*, spacers *I*, and the two members of the split die *D* are located. The spindle *B* is driven from the rear of the housing and revolves in the housing, the speed being determined by trial. The backing pieces *G*, which come in contact with the rollers, cause the dies to deliver hammer blows to the work at a rapid speed.

Wedges *H* are controlled from the rear of the housing, and can be withdrawn to allow the dies to spread sufficiently to permit inserting a new piece of work. The die members are held in a central position and spread slightly—when not closed in by the contact of the rollers with the pieces *G*—by wedges *J* which are backed up by coil springs.

Rochester, N. Y. EDWARD T. HEARD



Swaging Die for Wire and Tubing



Scriber for Use on Milling Machine Arbor

LAY-OUT SCRIBER FOR MILLING MACHINE

The milling machine, with its longitudinal and cross-feeds controlled by feed-screws equipped with micrometer dials, can often be used to advantage in scribing lay-out lines for holes that must be accurately spaced. For lay-out work of this kind, the work is fastened to the table of the machine and a scribing tool fastened to the machine arbor or spindle.

The scriber shown in the accompanying illustration, which was designed for work of this kind, is simple to make and exerts just sufficient pressure on the work to produce distinct lines or marks. Obviously, a solid scriber would not be satisfactory, as it would be difficult to adjust the table to give just the right amount of pressure on the point of the scriber. With the design shown in the illustration, the weight of the ring or collar *A* determines the amount of pressure on the work.

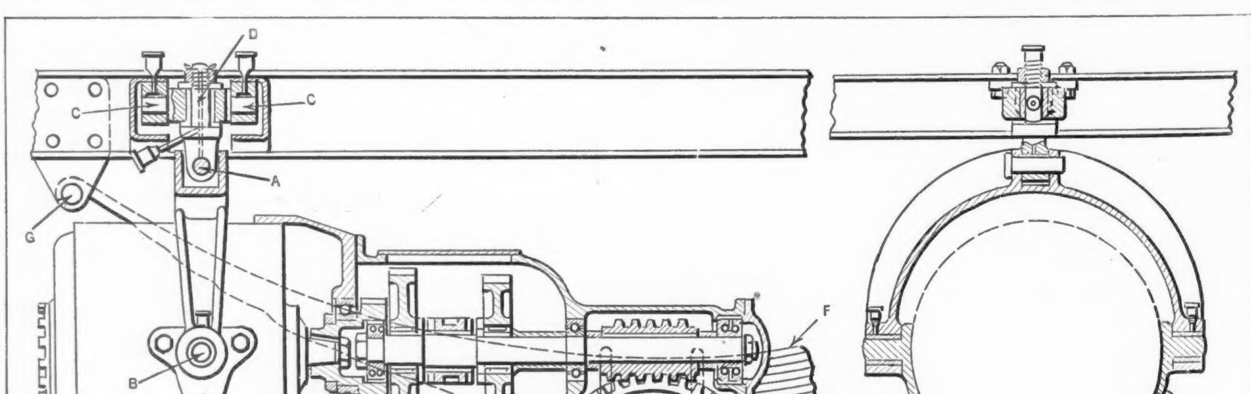
The collar *B* is made to fit the milling machine spindle *E*. The scriber *C* is a tight fit in collar *A*, as is also the pin *D*. Both the scriber and pin *D* are close sliding fits in the collar *B*. There is sufficient space at the upper end of the scriber *C* to allow collar *A* to move upward an amount equal to the clearance between the two collars. When in use, the collar *B* is clamped to the spindle of the milling machine, the same as a milling cutter, the spindle is locked in a stationary position, and the table moved upward until the point of scriber *C* rests on the work. If necessary, the scribing point can be used as a center-punch by tapping the top of ring *A* with a light hammer.

Hamilton, Ontario, Canada HARRY MOORE

UNIVERSAL MOTOR HANGER FOR ELECTRICALLY DRIVEN VEHICLE

In the accompanying illustration is shown a method of supporting or mounting the motor of an electric vehicle in which there are no propeller shafts, universal joints, or chain drives, such as are ordinarily employed to compensate for spring deflections caused by irregularities in the road. The hanger, motor, and transmission case comprise a complete unit. A straight-line drive is obtained with this arrangement, in which accurate alignment of the moving or driving members is maintained, regardless of the load or condition of the road over which the vehicle travels. It will be noted that no radius rods or torsion members of the usual type are employed and that the axle housing is attached directly to the springs.

It will be apparent from the illustration that any upward or downward movement of the vehicle frame in relation to the axle has no effect on the alignment of the driving members, owing to the rocking movements permitted by the pin *A* and trunnion bearings *B*. Any forward or backward movement of the rear axle is taken care of in the same way. The trunnion bearings *C* and the trunnion *D* permit the rear axle to move sidewise without affecting the alignment of the driving members. The swivel bearings for the rear axle *E* are connected to the springs, and are held in place between fixed collars on the rear axle housing. This con-



Motor Drive for Electric Truck, so Arranged that Accurate Alignment of the Driving Members is Maintained

struction allows both ends of the axle to move freely without affecting the alignment of the driving shafts. The front end of spring F is supported by a pivot bearing pin G, rigidly secured to the frame hanger without the usual link arrangement. The rear end of the spring, however, is attached to the frame by means of the customary link.

With the type of drive described a wheel of the vehicle can be run up on the curb, or allowed to drop into a hole, or strike an obstruction with sufficient force to move the axle backward or forward without straining the mechanism in any way. The starting or stopping torque of the motor acts directly upward through the yoke, and does not cause the motor to "jump" when the vehicle is started or stopped suddenly. A considerable number of light electric trucks equipped with motors mounted as shown in the accompanying illustration are in successful operation.

Roselle, N. J. W. R. GRAHAM

BENDING DIE FOR SHEET-METAL PART

The die shown diagrammatically in Fig. 2 is used on a single-action press for bending the inner edges of the cut-away portion of a sheet-metal part. One of the sheet-metal pieces on which the inner edges A and B have been bent or formed to the required angle of 150 degrees is shown in Fig. 1. The piece to be bent is placed on the die, as shown at W in Fig. 2. When the press is tripped, the two spring pads D, descending slightly in advance of the bending punch E, come in contact with the work and hold it in place while the bending die forms the right-angle bends at C.

As the punch continues its downward movement, the end M of the central member F comes in contact with the base of the die. Member F then remains stationary while the bending member E and the two members G, which transmit the required bending force from the punch pad H to member E, continue to move downward. This movement continues until a point is reached where the inner ends of members G slide past the ends J of the member F. The parts G are then allowed to slide inward,

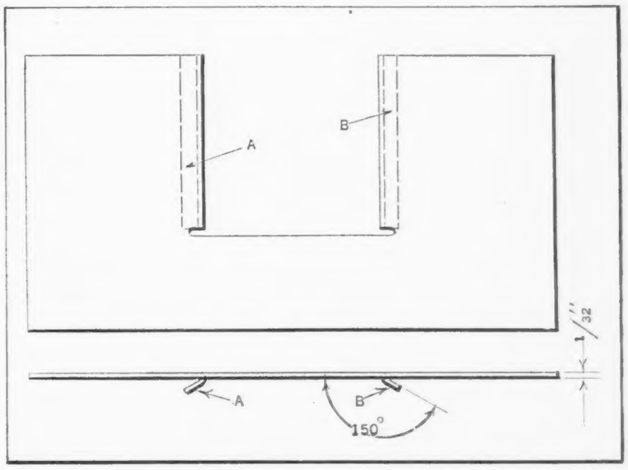


Fig. 1. Sheet-metal Part with Bent Edges

which, in turn, permits the bending member E to remain stationary when it comes in contact with part I of the die after completing the 90-degree bends.

In moving inward, the parts G slide on the lower side of the punch-holder H, being forced over by the cam or wedge surfaces of part E, which remains stationary. The lower end of part F is of such length that the ends J will pass out of contact with members G immediately after the 90-degree bends are completed and just before part E comes in contact with the members I.

A further downward movement of the punch brings the wedge or cam surfaces of the pieces K into contact with the bending members L, causing them to slide outward and complete the bending operation. At the end of the upward stroke of the press ram, the upper end of the central member F comes in contact with a knock-out bar, causing the sliding members G to resume their normal operating positions, ready for the next bending operation.

Detroit, Mich. G. RUNQUIST

DOUBLE-LOADING DRILL JIG

The drill jig here illustrated is for holding cast-iron brackets while drilling two 7/16-inch holes in

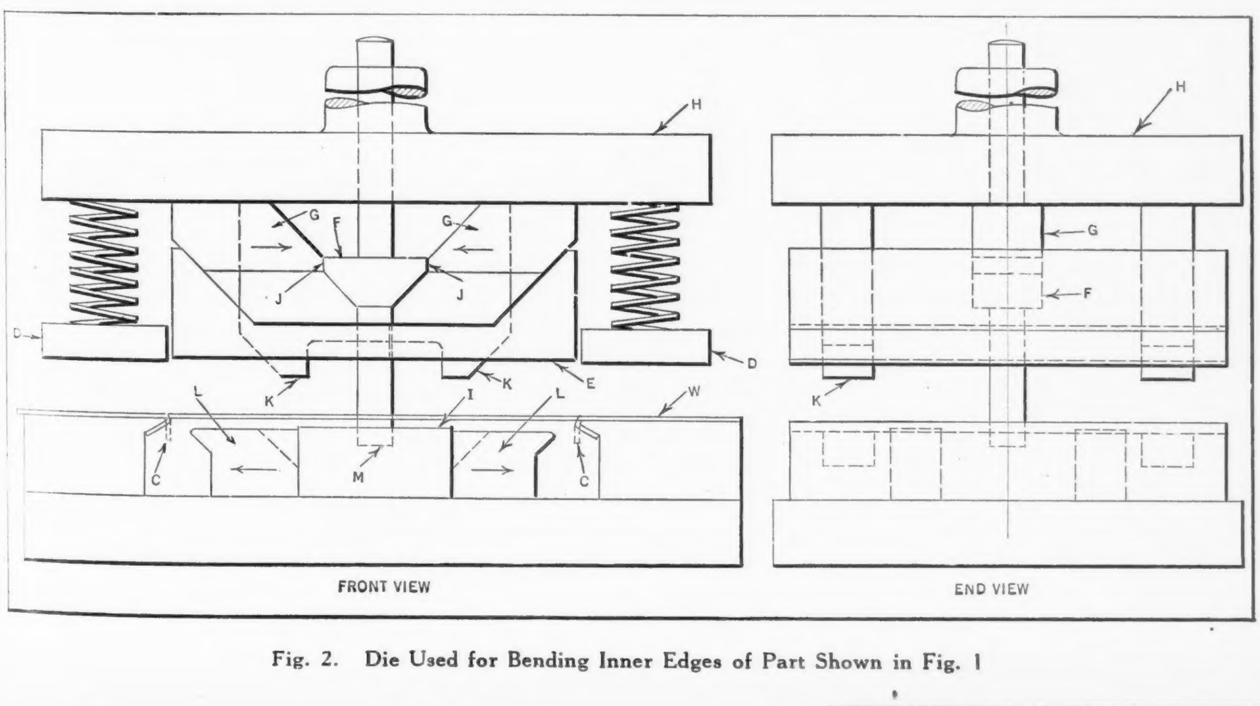
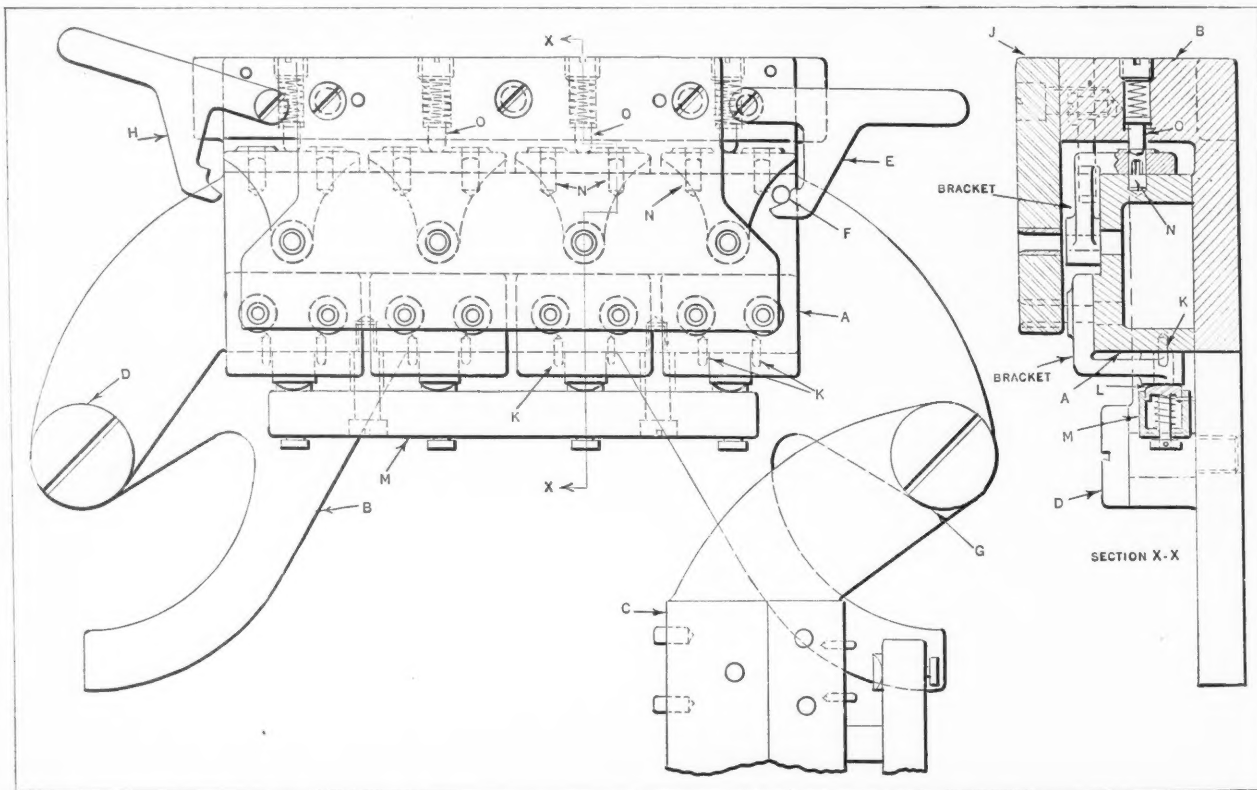


Fig. 2. Die Used for Bending Inner Edges of Part Shown in Fig. 1

the base of each, and one 7/16-inch hole through a boss on the right-angle flange. The brackets are used on an automatic bread-wrapping machine. Almost continuous production is obtained with this jig, due to the fact that there are two work locating and holding blocks pivoted on opposite sides of the jig base, thus providing a double loading feature. In this way, one set of brackets is mounted in the work-holding block while the drills are being fed through the brackets in the other holding block located in the base of the jig. The jig is used on a multiple-spindle drilling machine for this operation.

Work-holding block *A* is locked in the base *B*, ready for the drilling operation, while work-holding block *C* is swung forward for reloading. Block *A* swings in and out of position on shouldered screw *D*, and is locked in the drilling position by latch *E*



Jig with Two Work-holding Blocks that Enable One Set of Parts to be Loaded while Another Set is being Drilled

and pin *F* in the holder. Block *C* swings on shouldered screw *G*, and is locked in the drilling position by the latch *H* and a pin placed similarly to *F*. To support the work-holders in the loading positions, the base *B* has two curved projections. Screwed and doweled to the base and projecting over the work-holder when in the drilling position is the drill guide bushing plate *J*.

In loading the jig, four blocks are first placed on the outer side of the work-holder, with their bases up, and the small end of the bracket is located by two pins *K*. The brackets are held in place by four spring-actuated plungers *L*, set in bar *M*, and are fastened and spaced to the work-holder by screws and bushings. After being drilled, these four brackets are transferred to the back of the holder, where they are located by pins *N* and held on these pins by the spring-actuated plungers *O*; four undrilled brackets are put in their places on the outside of the work-holder. By alternating the work-holders, the drilling is almost continuous, and production has been increased on these brackets approximately 70 per cent.

Bridgeport, Conn. J. E. FENNO

STRETCHING AND FASTENING DRAWING PAPER ON LARGE BOARDS

The stretching and fastening of a sheet of drawing paper of large size, for original and accurate lay-out work, is quite a problem. The best results will probably be obtained by following the simple method described here. Where a lay-out table of 20 feet or so in length is to be covered, the sheet, as cut from the roll, should be 6 inches longer than the length of the board. Linen-backed manilla paper should be used. After folding a 2-inch seam on all four edges, the paper is ready to be laid, but before attempting to do this, have everything required at hand. Two hammers, a box of copper tacks, a pitcher of water, and a sponge will be needed.

First wet the entire surface of the paper with the sponge, making sure that the paper is evenly soaked. Up until now, the paper is not fastened to the board, but now no time is to be lost. Start tacking down the paper from the center and proceed along both edges, working very fast out toward the ends. Do not give the paper a chance to dry. Two or more men should do the tacking, one along each seam, while another should move just ahead of them, keeping the paper soaked. Each seam should be fastened with three rows of tacks spaced 1/2 inch apart and staggered. The corners should be reinforced with twice as many tacks.

After the paper is tacked down, it should be left to dry out for at least three days before attempting to draw anything on it. It is surprising how tight

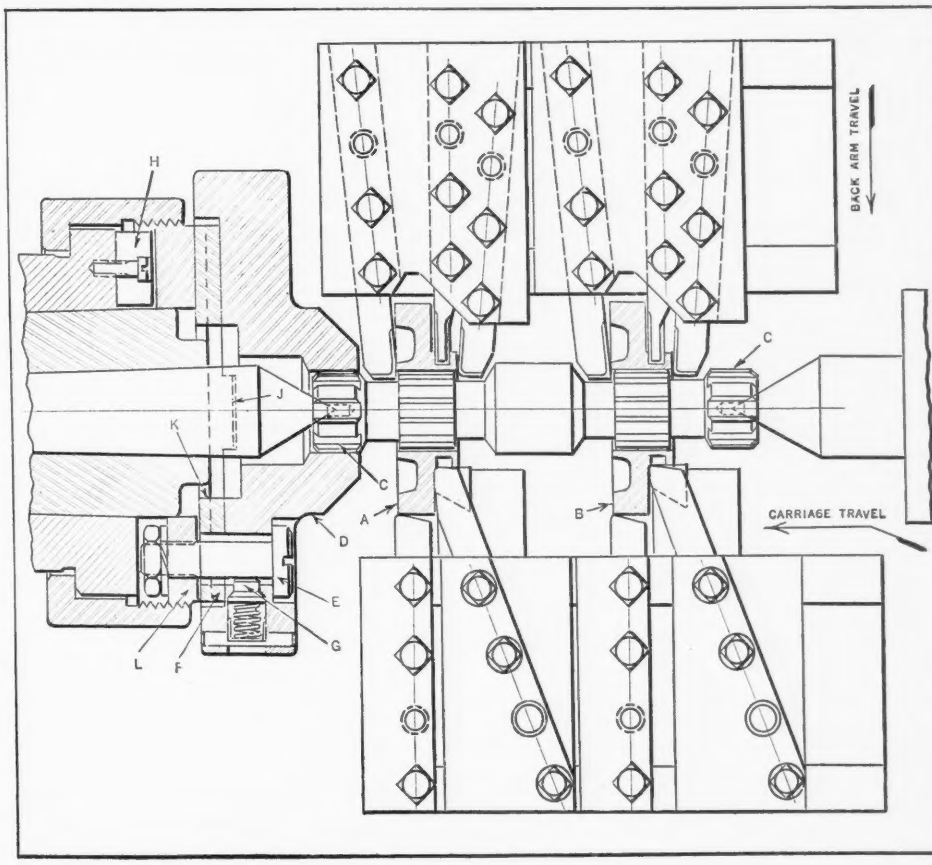
the paper will draw after the water drys out. By soaking the paper before tacking it down, it will be in its stretched stage, and after it is fastened to the board and starts to dry, it will shrink and draw very tight. It is best not to attempt to mount the paper on a board on a clear dry day, for when a damp day arrives, the moisture in the atmosphere will tend to swell the paper.

Philadelphia, Pa. MORTON SCHWAM

TURNING SLIDE GEAR BLANKS

Tool equipment employed on an automatic lathe for turning two gear blanks *A* and *B* simultaneously is shown in the accompanying illustration. The blanks are for main shaft slide gears of automobile transmissions, and are required to be very accurate. The close limits demanded on the finished holes in the blanks gave the tool designer a fair degree of assurance that the necessary accuracy could be maintained by holding the work as shown. Obviously, the supporting mandrels were required to be very accurate. One of the important requirements was that these mandrels preserve the fluted holes in perfect condition.

Referring to the illustration, it will be noted that the front and back tool-blocks hold all the tools necessary for completely machining the blanks. The fluted ends *C* of the mandrels serve as pilots for starting the blanks when they are forced on the mandrels. These fluted ends are made slightly smaller than the flutes that hold the blanks in the working positions. The blanks are uniformly located on the mandrels by gages or stops. The centers in the ends of all mandrels are made exactly the same depth, so that uniform positioning in the lathe is assured.



Gear Blank Turning Equipment Used on Automatic Lathe

A distinguishing feature of the equipment is the floating drive plate, which insures accurate positioning of the mandrels on the centers. The mandrel is driven from the spindle by an arrangement similar to an Oldham coupling. The outer member *D* has lugs which grip the fluted end of the mandrel. Three equally spaced bolts *E* in the plate *L*, which pass through clearance holes in the drive plate *F*, are acted upon by spring pins *G* which tend to centralize the outer driving member *D*. Projecting keys *J* and *K* located at right angles on opposite sides of plate *F* serve to transmit the driving motion from the spindle nose to the work mandrel. As the keys on plate *F* are sliding fits in their corresponding slots in plate *L* and the drive plate *D*, the latter member has a floating action which prevents the mandrel from being thrown off center. The key at *H* insures a positive drive between the machine spindle and plate *L*.

Springfield, Vt. O. S. MARSHALL

HOW A FORGE FIRE WAS SPOILED FOR WELDING

Frequently we have occasion to weld 5/8-inch steel rods or spikes to the centers of flat steel pieces, 12 inches long by 1/4 inch thick by 1 1/4 inches wide, so that the spike is at an angle of 90 degrees with the flat piece. As the production is somewhat limited, the welds are made by heating the pieces in a soft coal fire in a blacksmith forge. Some time ago great difficulty was experienced in obtaining a welding heat in some of the forges. This trouble occurred several times and naturally caused considerable annoyance. The coal was analyzed for sulphur content, and the steel for both sulphur and phosphorus, without locating the source of the trouble.

One morning the foreman of the forge shop saw a repair man from the tool-room melting a ladle of babbitt metal at one of the forges. He immediately had the fire pot of the forge cleaned out. Every trace of coal was removed, the tuyere cleaned, and the fire rebuilt with fresh coal. This removed the trouble. The following morning, before the results of this experiment had been made known to the repair man, another ladle of babbitt was melted in the same fire unknown to the foreman. Again trouble was experienced in making a weld. Investigation disclosed the fact that more babbitt had been melted in the forge. After a second cleaning of the fire, no trouble was experienced.

Since this experience, all forges have been thoroughly cleaned and no more trouble has been encountered. The ordinary rebuilding and cleaning of fires, such as is done every day, is not sufficient to remove the effect of melting babbitt in a forge. Whether or not the babbitt metal was spilled on the coal could not be determined, but prohibiting the use of the forge fires for melting babbitt metal has eliminated all difficulty in making welds.

Lockport, N. Y. B. A. LEE

MILLING CIRCULAR CLEARANCE ON UNIVERSAL JOINT FLANGE YOKES

The universal joint flange illustrated in Fig. 1 was required to be machined on a quantity production basis in the shop of a large manufacturer of automotive parts. One of the operations, consisting of milling a circular clearance in the work (which is a steel forging) was performed in 0.73 minute by means of the set-up illustrated in Fig. 2. Previous to this operation, the flange is machined and the eight bolt holes are drilled. The finished flange and holes are used to locate the yoke in the fixture for this operation.

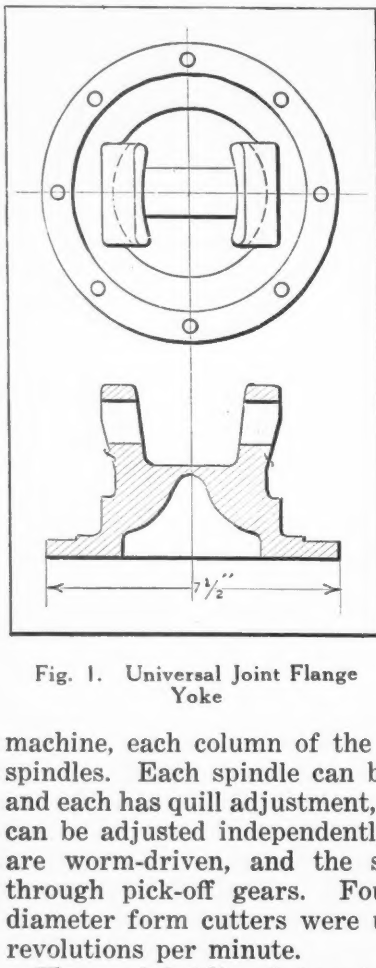


Fig. 1. Universal Joint Flange Yoke

The machine used is a duplex automatic milling machine, each column of the machine having two spindles. Each spindle can be adjusted vertically and each has quill adjustment, so that all the cutters can be adjusted independently. All four spindles are worm-driven, and the speed can be varied through pick-off gears. Four special 3 1/2-inch diameter form cutters were used, revolving at 81 revolutions per minute.

The work-holding fixture is bolted to one end of the milling machine table. It holds two yokes at a time, as shown. Two clamps actuated by a screw, clamp the work on each side. The fixture is driven from the rear drive shaft of the machine, the drive being carried up through bevel and spur gears to the work-holding and rotating fixture. The fixture is worm-driven, and the speed of rotation can be varied as desired.

The operation of the machine is almost entirely automatic. The operator's duties consist merely in reloading the fixtures. When the operator has loaded both sides of the fixture, he throws in the starting lever. The table is fed at a rapid rate until the center of the fixture coincides with the center line of the cutters. Then the table automatically stops and the rotary feed of the fixture is engaged, the fixture being rotated a little over a quarter of a revolution while each cutter mills one yoke arm. The rotary feed is then automatically thrown out, and the table returned to the starting point and stopped, when the operator reloads the fixture and starts the cycle of operations again.

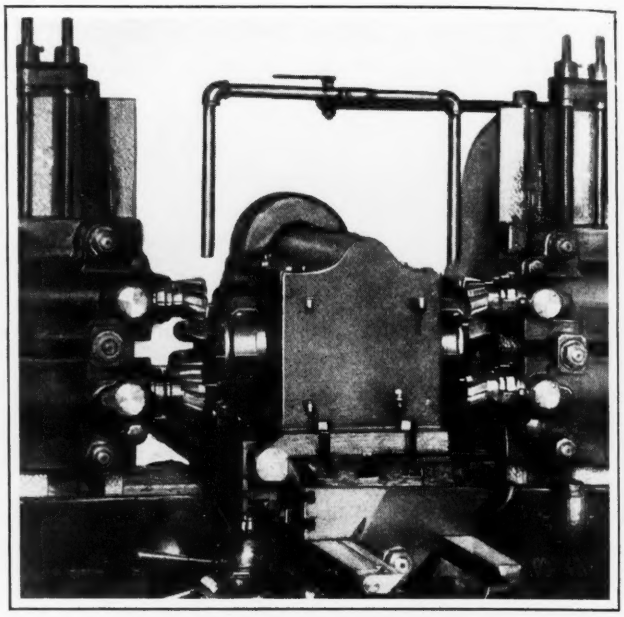


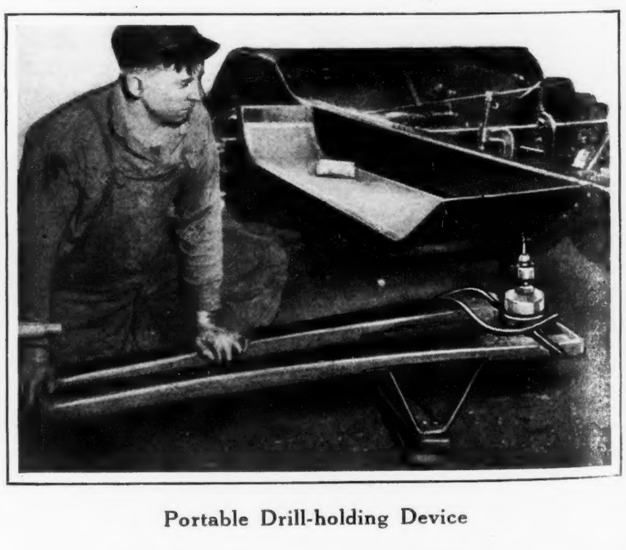
Fig. 2. Set-up for Automatically Milling Circular Clearance on Flange Yokes

Cincinnati, Ohio HOWARD ROWLAND

DRILLING FROM UNDERNEATH

Drilling holes from underneath, as, for example, when making repairs on automobile running boards, etc., has been conveniently done by using the portable drill-holding device shown in the accompanying illustration. The frame of the device consists of two heavy pieces of wood about 5 feet long, the outer ends of which are placed close together while the other ends are separated sufficiently to support an electric drill by its handles. Pieces of strap iron are used as cross-pieces to hold the frame together. The legs are also made of strap iron. They are so shaped that the frame may be rocked so as to raise or lower the drill. Short lengths of 2- by 4-inch wood may be used to block up the drill-holding frame to the required height to bring the drill into the working position.

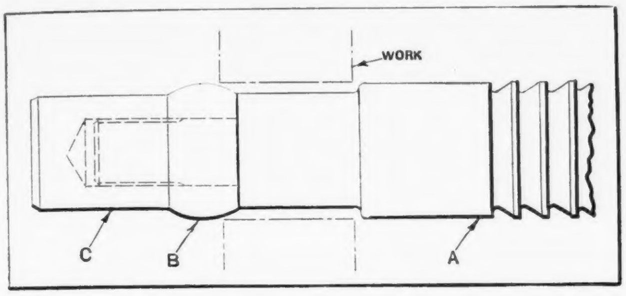
La Grange, Ill. AVERY E. GRANVILLE


Portable Drill-holding Device

Shop and Drafting-room Kinks

COMBINED BROACH AND BURNISHING TOOL

In order to obtain the required accuracy and finish for the shaft hole of a bronze pump rotor, it was the practice to broach the hole first and then



Broach Provided with Renewable Burnishing Ring

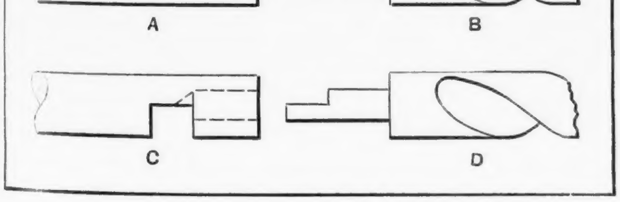
finish it to size with a burnishing tool. These two operations were performed on an arbor press.

With a view to increasing the production, the broaches were fitted with a burnishing tool, as shown in the accompanying illustration, so that both operations could be performed at one pass of the tool. The renewable burnishing tool or ring *B* is held on the shank of the broach *A* by means of the nut *C*. The burnishing surface is ground to a spherical shape, and has an outside diameter 0.002 inch larger than the diameter of the last broach tooth. This type of tool produces a very accurate and smooth hole.

Fairfield, Conn. J. E. FENNO

EXTENSION SHANKS FOR DRILLS

Frequently extra long drills for use in inaccessible places are required. One method of meeting such requirements is to drill out a piece of round stock of the required length and of the same diameter as the drill—see view *A* in the illustration—and then turn down the end of the drill as shown at *B* to form a free but close fit in the hole in the extension piece. It is not necessary to point the end as shown in the illustration. A little flux is placed in the drilled out hole, and the end of the drill is tinned and sweated into the extension piece. The extra long drill can thus be produced in ten minutes, which is less time than is often spent in a vain search around the shop for a drill of the required length.



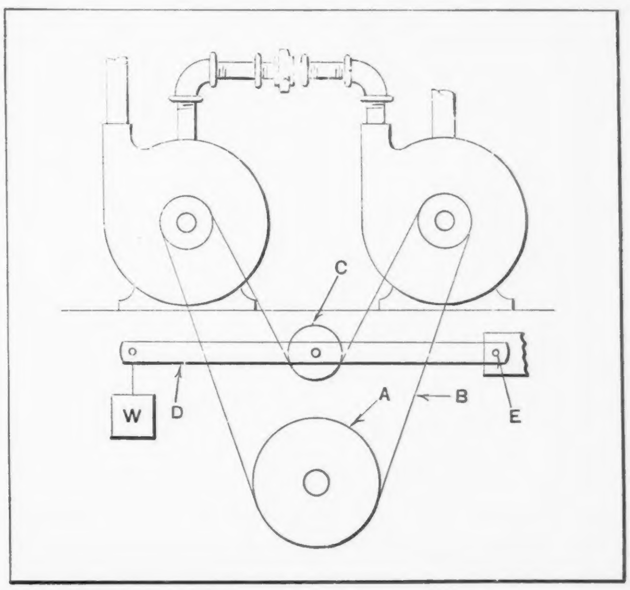
Methods of Joining Drills to Extension Shanks

Another method of joining the extension shank to the drill, which takes very little more time, is to drill the extension piece, as shown by the dotted lines at *C*, and file a slot just back of the drill-holder. The drill is turned down in a lathe, as shown at *D*, to form a tight fit in the extension piece. The end of the turned-down portion is then filed off, so that when inserted in the extension piece, the two flat surfaces will form a lock joint.

Brooklawn, N. J. JOHN F. HARDECKER

DRIVING TWO SERIES-CONNECTED CENTRIFUGAL PUMPS WITH ONE BELT

The accompanying illustration shows how the writer connected two centrifugal pumps in series and provided a single belt drive. It was necessary to employ two of these pumps, connected in series, in order to raise the water to a height greater than



Method of Driving Two Pumps with One Belt

was possible with a single pump. The pumps were mounted on the frame of an old automobile, the engine of which furnished the power.

Driving pulley *A* was mounted on a shaft connected directly with the engine. The belt *B*, which runs over the pulleys on the pump shafts, is kept at the proper tension by the idler pulley *C* mounted on the weighted arm *D*. This arm is free to swing on the pin or bearing *E* and carries the weight *W* at the other end.

Lyells, Va. W. R. WARD

* * *

There are 1,700,000 men employed on the railways of the United States, and the payroll of the railroads is over $2,900,000,000 annually. This makes the average annual wage of railway employes approximately $1700. In 1911, the average annual wage was $730.

Taper Shank Standardization

By THOMAS FISH, President, Ready Tool Co., Bridgeport, Conn.

THE writer read with interest the articles on standardizing taper shanks which have appeared in MACHINERY. The Ready Tool Co. has devoted considerable thought and study to this subject, in connection with the manufacture of high-speed centers, and from its own investigations has come to realize the large savings that could be made if one standard were agreed upon.

Practically all users of drills, reamers, arbors, counterbores, end-mills, cutters, collets, boring-bars, centers for lathes and grinders, and taper-shank tools used in portable drills, desire the adoption of a standard, so that all tools having taper shanks would be interchangeable, no matter in what type of machine they were used.

There are three tapers in general use—the Morse taper, the Brown & Sharpe, and the Jarno taper. Occasionally a taper of 5/8 inch to the foot is used. A taper of 3/4 inch to the foot is also used to some extent for large machines.

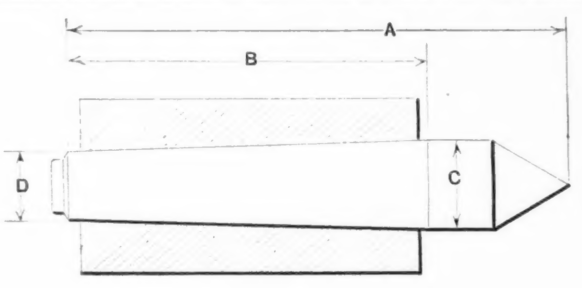
How the Standard Tapers were Originated

The first tapers originated were the Brown & Sharpe series, having a taper of 1/2 inch to the foot. These tapers first appeared in the year 1860 on the milling machines made by the Brown & Sharpe Mfg. Co. This taper system was followed by the Morse tapers having a taper of 5/8 inch to the foot. These tapers, which were used on drill presses and twist drills, appeared in the year 1862. In the same year, William Sellers & Co., Inc., advocated a taper of 3/4 inch to the foot, and in 1889 the Jarno taper was devised by O. J. Beale of the Brown & Sharpe Mfg. Co.

When the Morse tapers were originally laid out, it was intended to make the taper 5/8 inch to the foot, but owing to the limitation of early measuring methods, the standard evolved was found to have six different tapers divided into eight sizes, varying in the amount of taper from 0.600 to 0.630 inch per foot.

Tapers of Morse standard shanks are as follows: No. 0, 0.625; No. 4, 0.623; No. 5, 0.630; and No. 6, 0.626 inch to the foot. It will be noted that these numbers all have a taper of approximately 5/8 inch to the foot. The No. 1 Morse size has a taper of 0.600 inch to the foot; the No. 2, a taper of 0.602 inch to the foot; and the No. 3, a taper of 0.602 inch to the foot. These three sizes have approximately the same taper per foot as the Jarno standard (0.600 inch per foot). The Brown & Sharpe taper is 0.500 inch to the foot, with the exception of the No. 10 size, which has a taper of 0.5161 inch to the foot and is a size largely used.

In some respects, the Jarno taper is theoretically the ideal taper. With this system, the number of the taper indicates, in eighths of an inch, the large diameter; in tenths of an inch, the small diameter; and in half inches, the length. For example, the No. 8 Jarno taper has a diameter at the large end of 8/8 or 1 inch; a diameter at the small end of 0.8 inch, and a length of 8/2 inch or 4 inches.



Number of Taper	Diameter of Plug at Small End, Inches	Diameter of Socket at Large End, Inches	Length of Taper, Inches	Taper per Foot, Inches
	D	C	B	
0	0.269	0.356	1 3/4	0.600
1	0.369	0.475	2 1/8	0.600
2	0.572	0.700	2 9/16	0.600
3	0.779	0.938	3 3/16	0.600
4	1.020	1.231	4 1/16	0.625
5	1.478	1.748	5 3/16	0.625
6	2.116	2.553	7	0.750
7	2.750	3.312	9	0.750

Machinery

Fig. 1. Proposed Standard Tapers

Advantages and Disadvantages of Present Standard Tapers

The advantages of the Morse standard tapers are as follows: The medium sizes have good holding power and can be removed from sleeves or collets without too much trouble, and the lengths are approximately correct. In addition to this, the universal use of the Morse standard taper in this country and abroad is a good reason for its continued use.

The chief objections to the Morse standard are as follows: The large variety of tapers; tapers too steep for small sizes and not steep enough for the larger sizes. Some users believe that the two large sizes, Nos. 6 and 7, have a taper that is longer than is needed, and the same criticism also applies to the No. 1.

The comparatively small amount of taper of the Brown & Sharpe standards is an advantage in the small sizes, particularly for milling machine work. The objections are that there is one odd taper in the Brown & Sharpe system, namely, the No. 10 size; but this is not so objectionable as the small amount of taper in this system for larger sizes, which makes withdrawal from sleeves and collets difficult.

As regards the Jarno taper, its chief advantage consists in its uniformity and exact design formula, which can be easily remembered, one uniform taper applying to all numbers. The objection to this

taper, however, is the comparatively short length of the small sizes and the extremely long length of the larger sizes.

Present Applications of Standard Tapers

In present-day use, the Morse standard has been universally adopted for drilling machine spindles. This system has also been generally adopted for lathes, with the following exceptions: One manufacturer uses part Morse and part 5/8 inch to the foot tapers; another manufacturer employs a modified Morse taper in which the Morse standard taper is lengthened at both ends on sizes below No. 4; two other manufacturers, both of whom formerly used the Jarno taper, are each bringing out a new series of lathes having Morse taper centers.

For grinding machines, there seems to be no fixed standard. One manufacturer uses the Brown & Sharpe taper; another employs the Jarno, using a 0.6036 inch taper per foot on some of his machines, and a 0.6048 inch taper per foot on others. A third manufacturer uses a taper of 5/8 inch per foot, and a fourth uses the Morse taper, while another manufacturer who had been using the Jarno taper system recently changed over to the Brown & Sharpe standard.

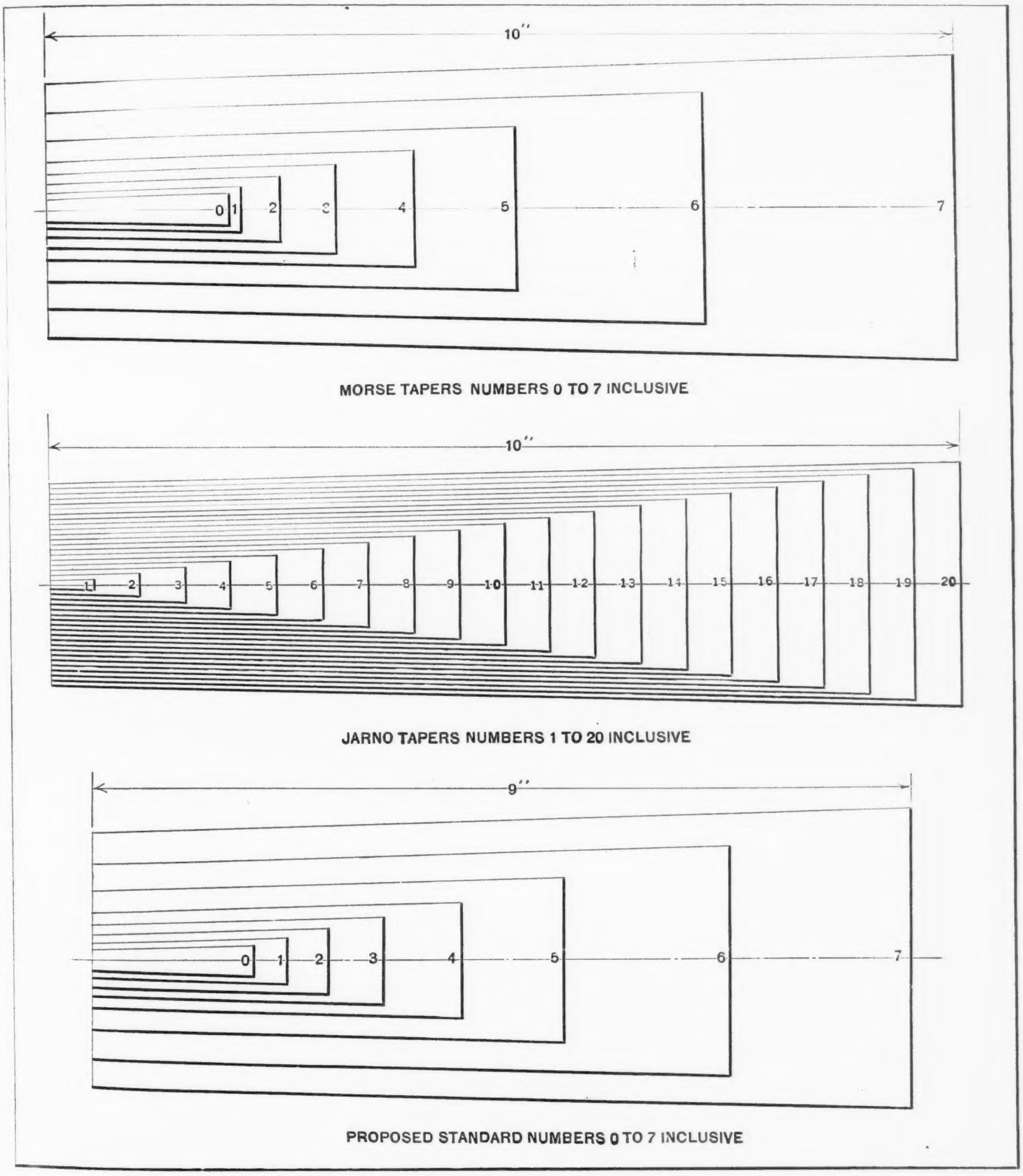


Fig. 2. Diagrams Showing Comparative Proportions and Sizes of Morse, Jarno, and Proposed Taper Standards

Greater Interest in Standardization Work Needed

In traveling through all parts of the country, the writer has come in contact with hundreds of users of machine tools, and has tried to obtain the opinions of the users regarding taper standardization.

While there is a demand for one standard, and in some plants such a measure would mean an immense saving, there seems to be a lack of interest in small shops, where there is a general tendency to stick to the standards now being used, in order to avoid trouble in making changes. On the whole, there probably is more of a desire to adhere to the Morse standard, because of this lack of interest on the part of the small shops. The large organizations, on the other hand, have a strong desire to standardize, and the writer believes that eventually this desire will lead to the adoption of one standard taper.

Proposed Standard Taper

After months of consideration and a great amount of work checking over the various tapers in an endeavor to reach something that might be acceptable, the writer has worked out the standard given in this article, which combines in one standard three different tapers per foot. This proposed standard may not be entirely successful, but it has been worked out with the thought that it might possibly lead to a plan that would eventually be acceptable to all users.

The dimensions of the new standard as worked out by the writer are given in Fig. 1. A comparison of the proposed tapers, which range from No. 0 to No. 7, can be readily made by referring to Fig. 2. The system makes use of the Jarno taper for the first four numbers or sizes, the next two sizes have a taper of 5/8 inch to the foot, and the last two sizes have a taper of 3/4 inch to the foot.

The reasons for selecting the different tapers suggested are as follows: The present Morse tapers, Nos. 1, 2, and 3, have practically the same taper per foot as the Jarno tapers. The next two Morse sizes, Nos. 4 and 5, have tapers that are practically 5/8 inch to the foot. Now the No. 6 Morse size has a taper of almost 5/8 inch to the foot, and the No. 7 size has a taper of 5/8 inch to the foot. It seems desirable to change these two sizes, increasing the taper of both to 3/4 inch to the foot, and at the same time shortening their lengths, a change for which there has been some demand.

The No. 0 Morse size, which has only limited use and is employed on special work, is now 5/8 inch to the foot. This undoubtedly resulted from a mistake in setting the original standard, and should be changed to 0.600 inch to the foot.

Comparison of Morse and Proposed Taper

A digest and comparison of the proposed standard with the Morse standard may be made as follows: The Morse taper No. 0 is changed from 5/8 inch to the foot to 6/10 inch to the foot for the proposed system, leaving the large diameter the same as the present Morse standard, enlarging the small diameter to 0.269 inch, and shortening the length 1/4 inch. The No. 1 Morse size already has a taper of 6/10 inch to the foot, and therefore requires no change.

For the No. 2 size, the standard Morse taper is practically 6/10 inch per foot, and the change of only a fraction of a thousandth is required on the small-end diameter to adapt the Morse standard to the new system. The No. 3 Morse taper is also practically 6/10 inch to the foot, and it is only necessary to change the diameter at the small end to 0.779 inch. The No. 4 taper, which is practically 5/8 inch to the foot, requires only slight changes. The No. 5 Morse taper has the same diameter at the large end as the proposed standard and the length is the same, but the small diameter is changed to 1.478 inches.

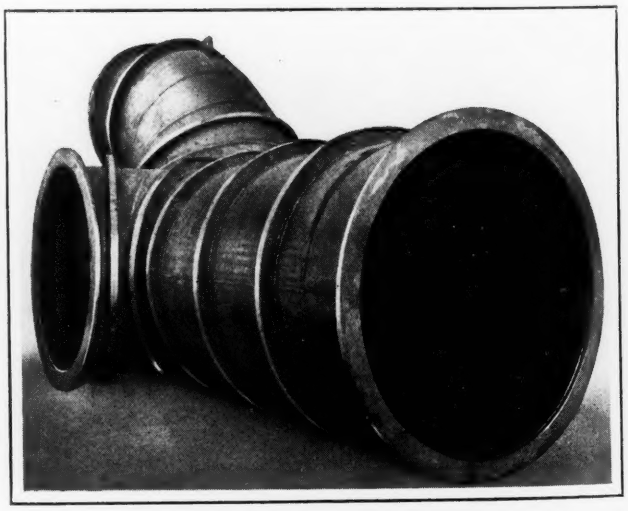
For the No. 6 size, the taper is changed to 3/4 inch per foot and the large diameter to 2.553 inches, the length shortened to 7 inches, and the small diameter is kept the same as the present Morse standard. In the No. 7 size, the taper is changed to 3/4 inch, the diameter at the large end increased to 3.312 inches, and the length shortened to 9 inches, leaving the small diameter the same as the present Morse standard.

All the changes described can be made in the present sleeves and collets at slight expense by reaming them out to take the new shanks, with the possible exception of the Nos. 0, 6, and 7 sizes. The changes in these three sizes are so desirable, however, that the writer believes that users will be willing to go to the necessary expense in order to make all their machines conform to a single standard and thus obtain full interchangeability of small tools and tool shanks.

* * *

WORLD'S LARGEST STEAM PIPE

The world's largest steam pipe has recently been completed in the plant of the Westinghouse Electric & Mfg. Co. at South Philadelphia, Pa. It is 7 feet in diameter, and is composed of sections of rolled steel which are joined together by arc-welding. It is to be installed in a large power plant, and will carry 1,600,000 pounds of steam per hour, at 40 pounds absolute pressure.



Arc-welded Steam Pipe, 7 Feet in Diameter

* * *

United States shipments abroad of industrial machinery during the seven months ended July, 1928, reached a total value of $120,760,000, and surpassed the trade of any corresponding period since 1921, being $14,200,000 in excess of that for 1927. If the present export activity is maintained during the remainder of the year, the volume for 1928 will equal that of 1921.

"Cloudburst" Process for Hardness Testing

THE convention of the American Society for Steel Treating, held in Philadelphia, Pa., October 8 to 12, simultaneously with the National Metal Exposition, proved an event of unusual interest to those having to do with the metallurgy, treatment, and use of metal products. At the technical sessions not less than forty papers were read on subjects covering almost every phase of metallurgy and the heat-treatment of metals. Among the many papers read one of especial interest to MACHINERY'S readers dealt with the "Cloudburst Process for Hardness Testing and Hardening." This paper was prepared by Edward G. Herbert of Manchester, England, and was presented by Robert B. Lewis of the Tinius Olsen Testing Machine Co., Philadelphia, Pa., which company makes and sells the machine used for this process of hardness testing in the United States.

General Action of the "Cloudburst" Testing Machine

The "Cloudburst" process consists essentially in bombarding an object to be tested for hardness with large quantities of hard steel balls, which strike the object with a predetermined and controlled velocity. The process may also be used for increasing the hardness of an object by the same means.

The most convenient method of causing the balls to move with a controlled velocity is to allow them to fall from a known height, and this method is adopted in the simplest form of "Cloudburst" machine used. Steel balls numbering 20,000 or more in the smallest machine, and usually of from 3 to 5 millimeters (approximately 0.120 to 0.200 inch) in diameter, are placed in a hopper surrounding a vertical pipe having ports near its top. The lower end of the pipe enters a rubber lined chamber. The hopper is raised to the top of the pipe and the balls pour through the ports and fall down the pipe into the chamber, where they strike the object to be tested or hardened.

The movement of the balls inside the pipe is first controlled by a regulating valve which serves to impede and, by a suitable adjustment, to regulate their flow. Having passed the regulating valve, the balls fall on a perforated piston suspended inside the pipe, which can be set at any desired height above the work-table in the chamber. The piston arrests the falling balls, but permits them to start afresh by passing through its perforations. The effective height of fall and, therefore, the effective velocity with which the balls strike the work is thus determined by the height of the piston within the pipe. This may be set, by means of a scale, at any predetermined height up to 13 feet.

The jet of balls produced is circular in section and about 2 inches in diameter. The work is placed on a table suspended within the chamber by four rods provided with ball joints. An indicator on the top of the chamber shows what part of the table is actually in line with the direct ball jet at any moment, and in this way the bombardment may be distributed over the work-table, or it may be concentrated on a particular area if desired. A rotary motion is provided for handling gears and other cylindrical objects, this motion being obtained through a handle and chain gearing.

There are various styles of "Cloudburst" machines. In the larger machines, the jet of balls takes the form of a thin sheet, the balls falling into the treating chamber through a long narrow slot in the adjustable piston. The work reciprocates beneath the flat jet of balls, so that every part of its surface is acted upon at each pass. For treating work in large quantities or articles of great length, a conveyor may be used to carry the work through the treating chamber.

The Principle of the "Cloudburst" Hardness Test

If a piece of steel is placed in a jet of hard steel balls moving at a certain velocity, the balls will rebound, leaving the surface unaffected if the steel is of a certain hardness, but will roughen the surface by indentations if the steel is below this hardness; and in the case of a piece of steel that is partly hard and partly soft, as for example, in a casehardened article in which there are soft spots, the exact shape and location of the soft areas will be revealed by the indented appearance, while the hard areas will show no marks. By selecting a suitable ball velocity, a surface of any desired hardness may be left unmarked, while any surface of less than the specified hardness will be easily detected by its indented appearance.

The advantages of the "Cloudburst" test are that it enables large numbers of articles to be tested simultaneously; it tests the whole surface, instead of only one or a few selected spots; and articles of correct hardness are unmarked by the test, while any soft areas are revealed in size, shape, and location.

In cases where it is necessary to make an accurate measurement of hardness for the purpose of controlling it between limits, a similar procedure may also be used, but a smaller number of impacts are employed, so that the impressions do not overlap and their diameter can be measured, for which purpose a special projection microscope is provided. The "Cloudburst" test does not add to the numerous scales of hardness that already exist. Conversion can readily be made from the diameter of "Cloudburst" impressions to Brinell, Rockwell, Shore, pendulum, or any other hardness scale.

The Process of Superhardening

A superficial layer of intense hardness is produced on any hard steel surface that has been worn under conditions so severe as to cause plastic deformation of the steel. In the "Cloudburst" superhardening process, such a condition is produced by bombarding the hard steel surface with hard steel

balls. In this case, balls 3 millimeters (0.120 inch) in diameter are usually employed, and the initial ball velocity is determined by the original hardness of the article to be treated. If too high a ball velocity is employed, the surface is roughened by indentations. The initial velocity must be such that the surface layer of the steel is slightly displaced, but not enough to roughen it.

When the surface has been completely covered by the light blows of the falling balls, it is found to be encased in a thin superhardened layer, which is capable of resisting indentation by balls striking it with an increased velocity, the hardened layer being simply increased in hardness and thickness by such treatment. By progressively increasing the ball velocity, a smooth surface of intense hardness may thus be produced.

Just as the "Cloudburst" hardness testing process can be prolonged to superharden a surface, so the same method can be applied to produce a work-hardened layer on soft steel and other metals. The principle is the same—the initial ball velocity must be adjusted to the original hardness of the surface, so as not to roughen it, and when the first stage of low velocity bombardment has been completed, the ball velocity is increased progressively until it reaches a maximum sufficient to induce the greatest hardness, but insufficient to roughen the surface.

Summary of Purposes of "Cloudburst" Process

The "Cloudburst" process of bombardment with hard steel balls has four principal functions:

1. The elimination of soft articles or articles having soft spots, the work being tested in quantity, all at once, and all over, and without marking surfaces of not less than a specified degree of hardness.
2. The measurement of hardness and its control between limits, the work being tested in quantity and over its whole surface.
3. The superhardening of hard steel.
4. The production of a work-hardened surface on steel, cast iron, and other metals.

"Carboloy," a Remarkable New Cutting Alloy

CUTTING a screw thread in a glass rod, boring a smooth hole in a block of concrete, handling porcelain on a lathe, and cutting the hardest of steels are among the things that can be done easily with a new kind of metal-cutting material described by Dr. Samuel L. Hoyt of the Research Laboratory of the General Electric Co. at the annual convention of the American Society for Steel Treating, held in Philadelphia, October 8 to 12. The new material, named "Carboloy," is composed of tungsten carbide and cobalt, the carbide being extremely hard and the cobalt giving the necessary strength for cutting tools.

The possibilities of this new tool material were indicated by Dr. Hoyt in referring to experiments conducted with molded materials containing metal inserts, such as fabric gears used in automobiles. The cutters that had previously given the best service in this work required redressing for every 150 parts machined, whereas tools made of the new material, when operated under identical conditions, finished 11,000 parts before they required sharpening.

Machining Highly Abrasive Materials

"The peculiar virtues of tungsten carbide promise to make it the dominant tool material in the field of weak or low-tensile materials, which are also uncommonly abrasive to present tools. Here the durability of "Carboloy" tools has been found to be of the order of twenty-five to seventy-five times that of high-speed tools," Dr. Hoyt said. "The new material can machine harder and denser grades of steel than can be handled economically by high-speed steel; and steels of a higher alloy content than are now commercially machineable will be brought into the machineable class."

The tungsten carbide tool quickly cuts glass, and can even be used for cutting a screw thread on a glass rod. Likewise, hard porcelain insulators can be machined on a shaper with the new material. For drilling a hole in concrete and rock, it previously was necessary to use either an expensive diamond drill or a "star" hammer drill, which really breaks its way roughly through the concrete. A drill made with the new cutting material has advantages over both of these types, in that it is less expensive than the diamond drill and cuts a smoother hole than the "star" hammer drill.

Cutting Materials Previously Believed Non-machineable

Hadfield's manganese steel, previously in the non-machineable class of metals, was found to yield so easily to the new cutter that development for commercial operation is expected. In the General Electric research laboratory, it has been found that numerous experimental alloys that could not be machined by the usual cutters could be handled by tungsten carbide cutters. It was found that even a block of quenched high-speed steel could be machined on the shaper with the new material, although with difficulty, and that the same held true with respect to the hardest high-speed alloys available for tests.

In testing high-speed steel, it is customary to use a nickel-steel test log, operating at about 50 feet per minute. Because of the lack of effect on the new cutter, however, it was necessary to increase the speed to 200 feet per minute. At this higher speed, a high-speed steel cutter failed in sixteen seconds, with its edge burned off. The tungsten carbide tool, operated under identical conditions, was run for an hour before the test was stopped, and the tool was still cutting and capable of cutting for a much longer period of time.

Avoiding Taper in Turning Due to Wear of Tools

One difficulty often experienced is the tapering of a piece of work caused by wear of the tool. In machining a hollow cylinder of carbon, for instance, the best tool steel loses its cutting edge and begins cutting a taper soon after starting. With tungsten carbide tools, however, an entire cut may be taken without the tool showing any appreciable wear, and hence without tapering the work. Genelite, which is composed of copper, tin, and carbon, is so soft that it can be whittled easily with a knife, but it is also so abrasive that it dulls a steel tool almost at once. A cut on a small cylinder only a few inches in length has always been on a taper; here, again, the tungsten carbide tools have not been worn, and hence the cuts are not tapered.

The bearing surfaces of electric motor commutators, which are composed of alternate layers of mica and copper, have always presented a problem, since they must be accurately machined and since mica is very abrasive. Here also the new material gives a smooth finish without undue wear.

Molded compounds, such as bakelite and hard rubber, also wear tools quickly. Diamond tools are used for bakelite, as these stones have previously been the only material to stand up at the high cutting speeds used. When the bakelite contained a metal insert, however, a special operation was needed, since the diamond would be broken if it struck the metal at high speed. With "Carboloy" no special operation is required.

Cutting through Chilled Surfaces of Castings

In considering cast iron, cutting conditions are often found to be severe. The parts are frequently large, the cutting speeds are lower, the cuts are heavier, and the tool pressures greater. One of the most difficult jobs with cast iron has been the removal of the surface layer of chilled metal, particularly when the surface contained sand. The chilled iron and sand are harder than tool steel, so that the edge of the cutter is taken off almost at once. Tungsten carbide, however, is harder than the surface of the cast iron, so that it can handle work of this kind without difficulty. In fact, the same speeds and feeds can generally be used for the surface as for the sub-surface cuts. Hard castings can be handled as easily as soft ones with the new material; and intermittent cuts are also handled satisfactorily.

Physical Properties of "Carboloy"

The extreme hardness of the new cutting material enables it to make deep scratches in ordinary window glass, just as though a diamond had been used. The natural sapphire, next below the diamond in the scale of hardness, is also scratched by tungsten carbide. If "Carboloy" is held against the side of an emery grinding wheel, a deep, narrow groove is worn in the stone without the "Carboloy" suffering much loss, whereas ordinary tool materials are worn away.

When it came to determining quantitatively the hardness of the new cutter, it was found that the usual Rockwell test was unsuitable, as the point of the diamond wore and crumbled in too short a time if the diamond penetrator was loaded with a weight. It was, therefore, necessary to use the penetrator without a load. The tests showed that common hardened tool steel has an average maximum hardness of 850 on the Brinell scale, that the hardest steel may be taken as about 1000, and that the hardness of "Carboloy" runs up to 2000 and above.

Strength and Toughness of "Carboloy"

The addition of cobalt to tungsten carbide increases its strength to more than half that of high-speed steel. Tungsten carbide without cobalt has a strength of less than 50,000 pounds per square inch, "Carboloy" a strength of up to 275,000 pounds, and quenched and tempered high-speed steel, 425,000 pounds.

Another important property of a cutter is toughness, and the new material will withstand quite severe blows of a soft peen on the edge of a bar. A supporting block of copper shows marked indentations as a result of the blows on the edge of the material, but the edge does not crumble. The strength and toughness of the material are further shown by its ability to take intermittent cuts on metals.

Hardness at High Temperatures

The tungsten carbide material does not pit or tarnish, and is dissolved in acids only with great difficulty. The moderate temperatures involved in cutting metals at the speeds generally used have not been observed to be harmful; but if the speed is raised too high and the abrasion is severe, small particles of carbide may oxidize and shoot off from the edge as sparks. Ordinarily, the temperatures involved simply produce temper colors, much the same as they do with high-speed steel.

The material retains its strength and hardness at high temperatures to a remarkable degree. Tools have been seen cutting nickel steel, with the point of the tool at a bright red heat, and no ill effects were observed. The material has no "temper" to be "drawn" by the heat generated, and it is much harder than the materials machined, even at high temperatures.

* * *

STICK BELT DRESSING

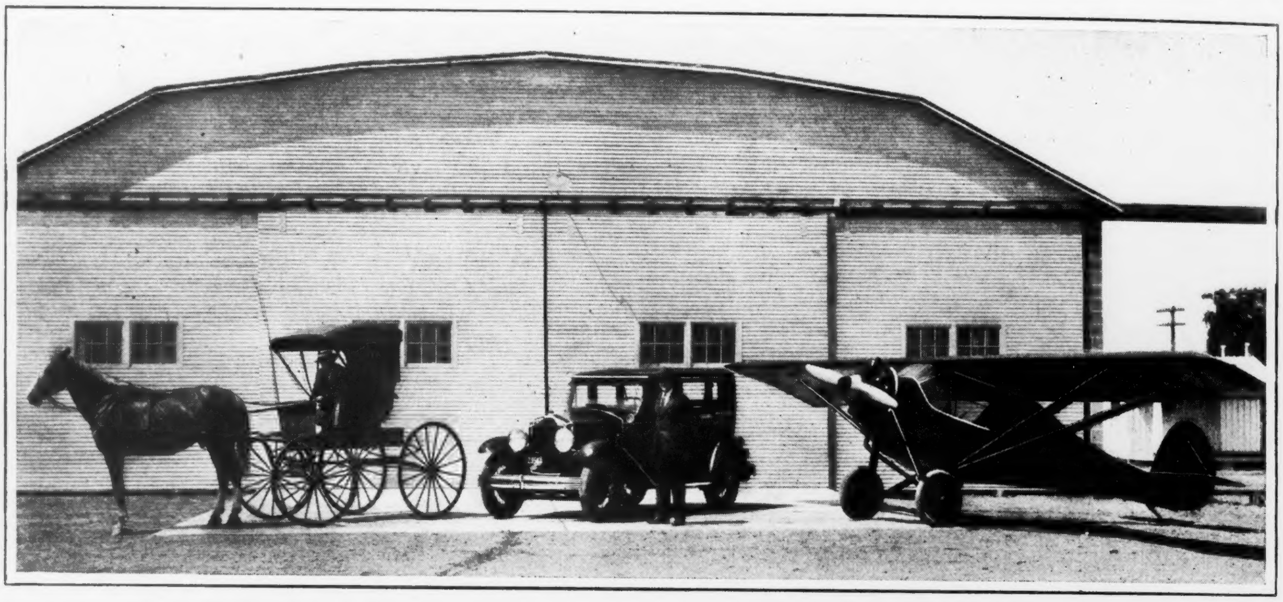
By H. L. KAUFFMAN

Shop foremen or plant managers who are anxious to economize will find that a stick belt dressing made according to the following formula will give satisfactory results. Dissolve 1.1 pounds of caustic soda in 1.1 pounds of water. Next melt together 10 pounds of raw degras and 5 pounds of lump rosin. Add the caustic soda solution to the degras and rosin, and cook the mixture until complete saponification has taken place, adding more water from time to time when necessary.

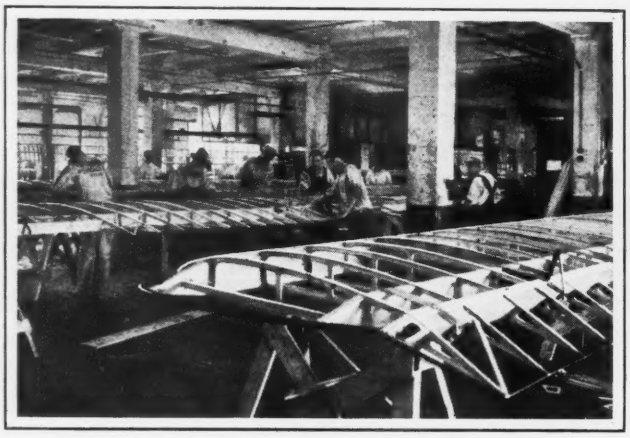
When the resulting mixture has cooled down to the point where it shows signs of setting, it should be poured into metal tubes, with stoppers at their lower ends, of a size calculated to hold 1 pound of dressing. When the dressing has cooled, it can be ejected from the tube by means of a wooden plunger. It is good practice to keep the stick dressing wrapped in waxed paper until ready for use.

Quantity Production of Airplanes

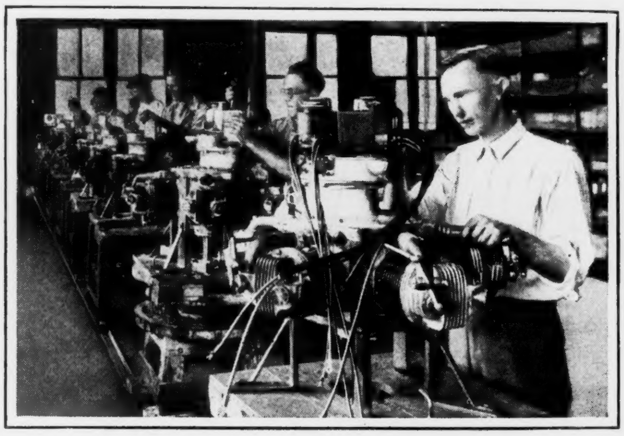
Photographs by Courtesy of J. B. Nealey



Three Stages in the Development of Transportation Means Illustrated by Velie Products 1901-1928



Section of Wing Construction Department of Mono-Aircraft Co., Subsidiary of Velie Motors Corporation, Moline, Ill.



Assembling Velie Five-cylinder 70-horsepower Air-cooled Radial Type Aircraft Engines for Monocoupes

Assembly Line of Monocoupes. The Monocoupe is a Two-seater Enclosed Monoplane Having a Speed of 100 Miles per Hour. It Carries 25 Gallons of Gasoline and Covers about 20 Miles per Gallon. Facilities Permit Increasing Production from 36 Planes per Week to 50 per Day, if Necessary

MACHINERY'S DATA SHEETS 141 and 142

HORSEPOWER TRANSMITTED BY SPUR GEARS—I

TABLES FOR DETERMINING HORSEPOWER TRANSMITTED BY GEARING

By ALFRED M. WASBAUER, Rockford, Ill.

The accompanying Data Sheet No. 142, and Data Sheets Nos. 143, 144, and 145 (to be published later), for determining the horsepower transmitted by steel spur gears can also be used for alloy steel gears, cast-iron gears, bakelite gears, or, in fact, gears made of any material, by changing the values given to conform with the working stress of the material. The data in these tables is based on the Lewis Formula.

For cast iron and bakelite, divide the values in the table by 3.5.

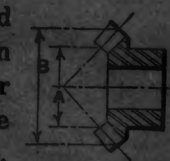
For casehardened nickel steel, multiply by 2.

For nickel-chromium and chromium-vanadium steel, heat-treated to a minimum hardness of 70 scleroscope, multiply by 3.5.

For bevel gears, multiply by the diameter A of the small pitch circle and divide the result by the diameter B of the large pitch circle (see accompanying diagram); hence, horsepower = value in table $\times \frac{A}{B}$

For herringbone gears, in general, divide by the cosine of the helix angle.

For Sykes type herringbone gears, multiply by 1.5. This gives values used by a well-known machinery builder for herringbone gears of this type.



It may be thought that the tables include gears having a greater number of teeth than would ever be used in actual practice, especially as the smaller gear determines the maximum horsepower transmitted. This would be the case if the tables applied only to ordinary speed reducing trains of gears. There are many cases, however, where the gap between two shafts, which must be bridged by a single pair of gears, is so great that the total number of teeth in the two gears must be large.

MACHINERY'S Data Sheet No. 141, New Series, November, 1928

HORSEPOWER TRANSMITTED BY SPUR GEARS—II

Horsepower Transmitted by 14 1/2-degree Cut, Heat-treated Steel Spur Gears Having 1-inch Face (Working Stress 30,000 Pounds per Square Inch) (See Data Sheet 141 for further directions)

Diametral Pitch	Number of Teeth	Velocity in Feet per Minute: 25	35	50	75	100	150	200	250	300	400	500	600
1	12	4.4	6.3	8.3	12.7	16.3	23.0	28.7	33.7	38.2	45.8	51.9	57.3
	14	4.7	6.7	9.4	13.7	17.5	24.8	30.8	36.2	41.0	49.4	55.8	61.7
	18	5.5	7.8	10.9	15.9	20.2	28.6	35.6	41.8	47.5	57.0	64.5	71.2
	24	6.3	9.0	12.6	18.2	23.2	32.8	41.0	48.2	54.5	65.5	74.0	82.0
	32	6.8	9.7	13.6	19.6	25.5	35.4	44.2	51.8	58.8	70.5	80.0	88.5
	48	7.3	10.5	14.7	21.2	27.2	38.4	47.8	56.2	63.5	76.5	86.5	95.5
	75	7.6	10.9	15.3	22.1	28.2	39.9	49.7	58.4	66.3	79.5	90.0	99.5
	125	7.8	11.2	15.7	22.7	29.0	41.0	51.0	60.0	68.0	81.6	92.5	102.0
	200	7.9	11.4	15.9	23.2	29.5	41.6	51.9	61.0	69.0	83.0	94.0	103.8
2	12	2.2	3.1	4.4	6.3	8.1	11.5	14.3	16.8	19.1	22.9	25.9	28.6
	14	2.3	3.8	4.7	6.8	8.7	12.4	15.4	18.1	20.5	24.7	27.9	30.8
	18	2.7	3.9	5.4	7.8	10.1	14.3	17.8	20.9	23.7	28.5	32.2	35.6
	24	3.1	4.5	6.3	8.1	11.6	16.4	20.5	24.1	27.2	32.7	37.0	41.0
	32	3.4	4.8	6.8	8.8	12.7	17.7	22.1	25.9	29.4	35.2	40.0	44.2
	48	3.6	5.2	7.3	10.6	13.6	19.2	23.9	28.1	31.7	38.2	43.2	47.7
	75	3.8	5.4	7.6	11.0	14.1	19.9	24.8	29.2	33.1	39.7	45.0	49.7
	125	3.4	5.6	7.8	11.3	14.5	20.5	25.5	30.0	34.0	40.8	46.2	51.0
	200	3.9	5.7	7.9	11.6	14.7	20.8	25.9	30.5	34.5	41.5	47.0	51.9
2½	12	1.7	2.5	3.5	5.1	6.5	9.2	11.5	13.5	15.3	18.3	20.8	23.0
	14	1.9	2.7	3.7	5.4	7.0	9.9	12.3	14.5	16.4	19.8	22.4	24.6
	18	2.2	3.1	4.3	6.3	8.0	11.4	14.2	16.7	19.0	22.8	25.8	28.5
	24	2.5	3.6	5.0	7.2	9.2	13.1	16.4	19.3	21.8	26.2	29.6	32.8
	32	2.7	3.8	5.4	7.8	10.2	14.2	17.7	80.7	23.9	28.2	32.0	35.4
	48	2.9	4.2	5.8	8.4	10.9	15.4	19.1	22.1	25.4	30.6	34.6	38.2
	75	3.0	4.3	6.1	8.8	11.3	16.0	19.9	23.4	26.5	31.8	36.0	39.8
	125	3.1	4.4	6.2	9.1	11.6	16.4	20.4	24.0	27.2	32.6	37.0	40.8
	200	3.1	4.5	6.3	9.3	11.8	16.6	20.8	24.4	27.6	33.2	37.6	41.5
3	12	1.3	2.1	2.9	4.2	5.4	7.7	9.6	11.2	12.4	15.3	17.3	19.1
	14	1.5	2.2	3.1	4.5	5.8	8.3	10.3	12.1	13.7	16.5	18.6	20.6
	18	1.8	2.6	3.6	5.3	6.7	9.5	11.9	13.9	15.8	19.0	21.5	23.7
	24	2.1	3.0	4.2	6.1	7.7	10.9	13.7	16.1	18.2	21.8	24.7	27.3
	32	2.2	3.2	4.5	6.5	8.5	11.8	14.4	17.3	19.6	23.5	26.7	29.5
	48	2.4	3.5	4.9	7.1	9.1	12.8	15.9	18.7	21.2	25.5	28.8	31.8
	75	2.5	3.6	5.1	7.4	9.4	13.3	16.6	19.5	22.1	26.5	30.0	33.2
	125	2.6	3.7	5.2	7.6	9.7	13.7	17.0	20.0	22.7	27.2	30.8	34.0
	200	2.6	3.8	5.3	7.7	9.8	13.9	17.3	20.3	23.0	27.7	31.3	34.6
4	12	1.1	1.5	2.2	3.1	4.0	5.7	7.1	8.4	9.5	11.4	12.9	14.3
	14	1.1	1.6	2.3	3.4	4.3	6.2	7.7	9.0	10.2	12.3	13.9	15.4
	18	1.3	1.9	2.7	3.9	5.0	7.1	8.9	10.4	11.9	14.2	16.1	17.8
	24	1.5	2.2	3.2	4.5	5.8	8.2	10.2	12.0	13.6	16.4	18.5	20.2
	32	1.7	2.5	3.4	4.9	6.3	8.8	11.0	12.9	14.7	17.6	20.0	22.1
	48	1.8	2.6	3.6	5.3	6.8	9.6	11.9	14.0	15.9	19.1	21.6	23.9
	75	1.9	2.7	3.8	5.5	7.0	9.9	12.4	14.6	16.6	19.9	22.5	24.9
	125	1.9	2.8	3.9	5.6	7.2	10.2	12.7	15.0	17.0	20.4	23.1	25.5
	200	2.0	2.8	3.9	5.8	7.3	10.4	13.0	15.2	17.3	20.7	23.5	25.9

MACHINERY'S Data Sheet No. 142, New Series, November, 1928

Contributed By A. Wasbauer

Gear Manufacturers' Meeting in Buffalo

THE American Gear Manufacturers' Association held its fall meeting in Buffalo, October 11 to 13. The meeting was unusually well attended and considerable progress was reported by the standardization committees. A number of papers of broad general interest were read at the meeting.

Effect of Arc Welding on Manufacturing

J. F. Lincoln, vice-president and general manager of the Lincoln Electric Co., Cleveland, Ohio, addressed the meeting on "The Application of Arc Welding to Manufacturing Processes." He outlined what his own company has done to solve the problem of redesigning machine frames and parts so as to use welded steel instead of castings. He also pointed out the reasons why progress in the adoption of arc welding has been comparatively slow. One of the points to which he gave particular attention was the matter of appearance of welded designs as compared with castings.

Among the advantages to be gained by electric welding, Mr. Lincoln pointed out that changes of design are more easily made, that deliveries of special machines can be greatly accelerated, that the weight of machinery can be considerably decreased while the strength is retained, that manufacturing floor space may be decreased both because less storage space is required and because less space is required for actual manufacturing operations.

The Gear Shaving Process

At a joint meeting of the American Gear Manufacturers' Association and the Machine Shop Practice Division of the American Society of Mechanical Engineers, held Friday, October 12, H. D. Tanner, manager of the gear division of the Pratt & Whitney Co., Hartford, Conn., read a paper on "The Pratt & Whitney Gear Shaving Process."

This process, which is the invention of James H. Barnes of Dayton, Ohio, is a method of generating involute spur and helical gears. In the machine built for this process, two tools are used, which generate the correct involute tooth curve on the teeth. The principle of the process may be described by the statement that the active profiles of the gear teeth are generated by rolling the gear in which the teeth are to be cut in mesh with a zero-degree rack. The active profiles of this rack are the top edges of its teeth, which coincide with the cutting edges of the tools. The form of the cutter is the simplest possible, and all expense connected with the making of any precision form used in the machine is confined to the making of a master involute cam.

It is preferable to rough-cut the gears in a hobbing machine, although a gear shaper can, and sometimes must, be used. This preference is due entirely to the more favorable shape for gear shaving produced at the base of the tooth by the hobbing method. All hobs are made to generate at a pressure angle of 15 degrees, as this produces more nearly the desired shape in the under-cut curves. For the same reason, all gears are cut to full Fellows depth. Otherwise, hobs are made and used the same as in regular production roughing.

Any carbon tool steel that will hold a keen edge at a hardness of from 63 to 65 on the Rockwell C-scale is satisfactory for the gear shaving cutting tools. Such tools will cut from 500 to 1200 teeth after grinding, depending largely upon the machineability of the gear material. Honing of the cutting edges in the machine will usually give half as many teeth again before the tools need regrinding. The usual cutting compounds are satisfactory for the gear shaving machine, and no unusual heat-treatment of the gears before cutting is necessary, although a material a little harder than is customary seems to give the best results.

As the final active profile of a shaved gear is produced by one pass of one cutting edge, there is a continuous surface in the direction of roll or slide.

High-speed Helical Gearing

A paper on high-speed helical reduction gearing was presented by Ira Short, marine engineer of the South Philadelphia Works of the Westinghouse Electric & Mfg. Co., at the joint meeting of the American Gear Manufacturers' Association and the Machine Shop Practice Division of the American Society of Mechanical Engineers. In this paper, Mr. Short briefly traced the history of high-speed reduction gearing, explained the action of the gears, and dealt with such subjects as wear due to pitting, allowable load on the teeth, importance of correct alignment, lubrication of the gears, and noise in the gears and its elimination. Illustrations of a number of typical gears were shown on the screen.

Regarding the allowable load on the teeth, Mr. Short mentioned that if correct alignment is maintained to insure uniform tooth contact, a tooth pressure of 100 pounds per linear inch of width of face per inch of pitch diameter may be safely carried. A pressure as great as 320 pounds per inch of face per inch of diameter has been carried with no signs of failure.

In other words, with a 5-inch pinion, a pressure of 500 pounds per inch of face can be safely used, and with a 10-inch pinion, 1000 pounds. The reason for this variation is that the allowable load that can be continuously carried on a gear tooth is directly proportional to the radius of curvature of the contacting teeth. For all practical purposes, the radius of curvature can be taken as being directly proportional to the pitch diameter. The pinion tooth having the smaller radius of curvature, therefore, limits the allowable load.

Inspection of Gears

A paper entitled "Predetermining Quality Gearing" was read by Russell M. Coldwell, of the Fellows Gear Shaper Co., Springfield, Vt. This paper dealt with some of the measuring instruments used to maintain a predetermined quality of gearing. The author also described a machine built by the Fellows Gear Shaper Co., whereby tooth shapes in gears may be permanently recorded on a diagram having the general appearance of temperature recording charts. Many examples were shown by Mr. Coldwell to illustrate how different errors in tooth shape and spacing appear on the indicator diagram.

Abrasives for Gear Lapping

In an address "The Manufactured Abrasives for Gear Lapping," H. J. Willis, research engineer of the Carborundum Co., Niagara Falls, N. Y., pointed out the advantages that accrue from the lapping of certain classes of gears, and then gave an outline of the kinds of abrasives that may be used for this kind of work. He pointed out that natural abrasives, such as emery, are not generally suitable for lapping, but only for polishing. Ground glass has been proposed at times, but it is not suitable for hard gears and is too "splintery" for soft gears.

Of the manufactured abrasives, some grades of crystalline alumina are suitable for soft gears, but are too soft for hard gears. Carbide of silicon is best suited for hard gears, but is too sharp for soft gears. The black variety is best for gear lapping. In all cases, the abrasive must be selected for the softest gear in a pair of gears.

The usual practice in lapping gears is to make up a batch of grain and oil and use it until it is either exhausted or the grains broken down. By this method, the lapping action is constantly changing as the grain breaks down. To offset this, the grain should be constantly freshened with a daily addition of fresh grains and oil.

Too little attention is paid to the selection of the vehicle for carrying the abrasive grain, but finishing compounds are now available on the market suitable for different kinds of lapping operations. In conclusion, the author mentioned the importance of cleaning lapped gears. No matter what abrasive is used, the gears should be cleaned off thoroughly.

Among the committee reports presented at the meeting, a report with formulas and tables for the selection of gears to meet given conditions, presented by the Spur Gear Committee, deserves mention. The Metallurgical Committee also presented a progress report that ultimately will become of great value in the gear industry for the standardization of gear steels.

* * *

The fuselage of a late type of airplane is of the plywood type. In the construction, a die or mold made of concrete is employed, the inside of this mold being made to conform to the outer contour of the fuselage. After the wood is fitted to the inside of this concrete form or die, a punch member is pressed down into it. In this manner, the exact forming of the fuselage is accomplished.

THE BRITISH METAL-WORKING INDUSTRIES

From MACHINERY'S Special Correspondent

October 15, 1928

As long as the total number of unemployed remains at the present high figure it is impossible to be optimistic concerning trade conditions in the country as a whole. The number of unemployed on September 24, the last date for which figures are available, was 1,295,200, which is 245,100 more than a year ago. Nevertheless, evidence is not wanting that, in many branches of the metal-working industries, conditions are decidedly better than for some months, and the outlook for the remainder of the year is favorable. It is as well to bear in mind that unemployed miners account for nearly one quarter of the unemployed, and that so far as can be ascertained at present, there are about 180,000 miners who can never hope to return to their former occupation.

Inquiries Good in the Machine Tool Industry

The machine tool industry, in common with most other industries, has passed through a period of depression since the war, but at the recent Machine Tool and Engineering Exhibition at Olympia, widespread optimism prevailed, and judging by the number of inquiries received, and orders placed, not without reason. The volume of orders on hand in the industry is greater than at any time since 1920, and many machine tool makers are unable to cope with the demand, in spite of the fact that over-time is general throughout the industry.

Despite complaints that trade conditions in the shipbuilding industry on the Clyde are bad, the tonnage launched each month has been quite up to the normal level of pre-war years. During September, 13 vessels were launched, having a total tonnage of 69,620, and the aggregate for the first nine months of the year is now 160 vessels of 485,823 tons. The latter figure is only 3600 tons below the record for the first nine months of any year.

The Automobile Industry

In the automobile industry, the departments dealing with the preparatory work for next season's extended programs are fully occupied; apart from this, there is only a lingering demand for output from the principal factories. This applies mainly to pleasure cars; heavy commercial and passenger-carrying vehicle manufacturers are well employed.

Regarding the year as a whole, the demand for automobiles has been good, but has not come up to the expectations of manufacturers, particularly in the field of cheap light cars. Manufacturers are for the most part actively preparing for a record season during the coming year. To this end, many important works are installing a considerable amount of new machinery and equipment.

The appearance of the new eight-horsepower Morris "Minor" will be of interest as marking the entry of still another British manufacturer into the field of ultra light cars. The increasing popularity of such cars is undoubtedly to be attributed in large measure to the high horsepower tax and the tax recently imposed on gasoline, both of which favor the development of small high-efficiency engines.

National Machine Tool Builders' Meeting

THE twenty-seventh annual convention of the National Machine Tool Builders' Association was held at Skytop Lodge, Cresco, Pa., October 23 to 26. Four general sessions were held, at each of which papers of importance to the machine tool industry were read and discussed. At the first session the meeting was called to order by the president of the association, P. E. Bliss, president of the Warner & Swasey Co., Cleveland, Ohio.

Following the president's opening remarks, H. I. Shepherd, vice-president of the Guardian Trust Co., Cleveland, Ohio, spoke on "Mutual Aid in Business." His address was followed by a paper entitled "Some Problems in the Marketing of Machine Tools," by H. B. Kraut, vice-president of the Giddings & Lewis Machine Tool Co., Fond du Lac, Wis. At the following sessions three other papers were presented: "What Trade Associations Mean to Industry," by Dr. Hugh P. Baker, manager of the Trade Association Department of the Chamber of Commerce of the United States; "Some Important Points on Machine Tool Cost Accounting," by Albert E. Grover, cost consultant on the staff of the National Machine Tool Builders' Association; and "Profit Ideals of the Machine Tool Industry," by Ernest F. DuBrul, general manager of the association.

The Service of Trade Associations

In his address entitled "Mutual Aid in Business," Mr. Shepherd emphasized the important part that trade and manufacturing associations play in the present economic structure. Starting with the idea that the primary instinct in the administration of any business seems to be self-preservation by entirely independent action, Mr. Shepherd emphasized that the idea of group action apparently comes only from considerable experience and after more or less adverse results.

Generally speaking, it is either the abuse of individual power or the folly of unintelligent competition that focusses attention on the soundness of an organization that controls, to some degree, the activities of individuals or corporations doing business in the same or allied fields. Mr. Shepherd stated that one did not have to look to small businesses to find the most outstanding examples of the failure to recognize the effectiveness of such mutual cooperation and control. This failure to appreciate the needs for cooperative action has been evident in some of the largest corporations, as for example, among the railroads, previous to the organization of the Interstate Commerce Commission. This commission was looked upon as an infringement on individual rights. Today, the regulating influence established by the Government is looked upon by railroad executives, the public, and the financial institutions of the country as a very satisfactory and beneficial method of securing cooperation both between the railroads themselves, and between the railroads and the industries that depend upon them for transportation.

The Need for Accurate Trade Statistics

Proceeding, Mr. Shepherd said: "Two things have happened in the last decade that are lifting business out of a certain haphazardness and making possible a sounder and safer development. One is increased knowledge and use of financial statements in the tying up of operation with executive administration, and the other is the organization of trade associations. The consolidation of many manufacturing or other operating units into one general organization, and the application of sound administration to all of these allied units through the use of concise and budgeted information has reached a very high degree of development. This fact, in itself, places the smaller operator at a disadvantage in many instances, both because of the lower cost on the larger volume, which is possible under large organization, and also because of the fact that the smaller organization has not at its disposal, acting by itself, the closely analyzed data upon which to base its operation. This is very often not because of the failure to appreciate the significance of the information, but because of the burden charge that would be added.

"This condition makes necessary the association of such units into a national or territorial organization, which can supply for its members something of the same expert analysis and advice that the larger organizations have within themselves. Most trades or allied lines of business have such associations, and the larger and better managed businesses of the country are generally found contributing freely and benefitting largely from them."

The Importance of Careful Cost Accounting

"In almost every line of trade there are one or more persons or organizations doing their business, ignorant of or wilfully ignoring, costs, or basing their prices upon competitors' catalogues, and estimating that their own costs must be as low as those of their competitors. These persons or organizations are selling their product at a loss or at no profit to themselves, but their volume or standing in the trade is sufficient to establish a price that compels most competitors to make a corresponding sacrifice in order to stay in business. Such an attitude is economically unsound."

Mr. Shepherd particularly tried to bring out in his paper that the great necessity today in business is a true picture upon which to base a decision. The demand is for an intelligent plan for the future, predicated upon the experience of the past. Such a plan presupposes and requires a comprehensive analysis of the elements that control business.

Many men in business, in spite of years of experience, fail because of their inability to formulate an intelligent plan for the future. On the other

hand, the extent to which this ability exists in any business organization measures to a large extent the degree of efficiency of the management. The forecasting of the future and an intelligent plan based upon this forecast, therefore, is one of the great essentials in present-day business. In this field, the trade association can render valuable service.

It is true that each man in business is often likely to think of his own particular activity as presenting a problem peculiar to itself and distinct from that of any other business. As a matter of fact, such differences are small in the same line of business, and though these differences exist when varied lines of business are considered, they are still of minor importance as compared with the principles that are common to practically all business. Hence, cooperation between manufacturers in the same line of business, as well as within the industrial field as a whole, is one of the ideals toward which American industry must tend if it is to succeed.

Careful Budgeting Means Careful Planning

With regard to budgeting, Mr. Shepherd stated that good management based on proper budgeting will be conducive to intelligent operation, will eliminate peaks of expense, reduce inventory, tend to produce continuity of operation, and eliminate peaks and valleys due to seasonal causes—thereby resulting in increased economies and, consequently, increased profits. Cost accounting and budgeting, however, should be applied with common sense. "It is not the expert statistician who is wanted," said Mr. Shepherd. "In fact, figures may be developed to a point where they become a nuisance in business. The anxiety to pigeon-hole the expense items in the right pocket often overshadows the anxiety of getting the profits in the right pocketbook."

On the subject of price-cutting, Mr. Shepherd said that this practice, whether based on ignorance or on design, is one of the greatest failures in modern business; and contrary to the popular conception, the evil does not lie at the door of the larger organizations as often as it does at the door of the smaller and uninformed organization. He stated as his belief that with the intelligent operation of smaller independent organizations, together with the final recognition of the mutuality of interest, it is possible that the next ten years will see the elimination of many of the uneconomic and wasteful practices that have characterized the last decade.

* * *

The American Gas Association has just opened a new testing laboratory in Cleveland, Ohio, erected by the organized gas industry, which is made up of gas companies and manufacturers of gas industry equipment. The association has conducted research and testing work for some time, but the new laboratory will furnish additional facilities. The building provides, roughly, 3200 square feet of office space, 8700 square feet of storage space, and 14,700 square feet devoted to appliance testing and research.

ENCYCLOPEDIA OF HANDBOOK TYPE

HANDBOOK ENCYCLOPEDIA OF ENGINEERING. 1242 pages, 4 1/2 by 7 inches. Published by THE INDUSTRIAL PRESS, 140-148 Lafayette St., New York City. Flexible, dark-blue, grained Atholeather binding; lettering and edges of pages in gold. Price, $6.

This new handbook is an engineering encyclopedia and mechanical dictionary combined, and it supplies in compact form the outstanding facts about a very large variety of important subjects related to engineering, machine design, and manufacturing practice. It is primarily a work of reference for those who want to get the main facts quickly, but a broad general knowledge may also be obtained from this book with comparatively little reading.

By confining the matter to the gist of each subject, it has been possible, within a single volume of ordinary handbook size, to deal with thousands of items covering such a wide range that it is impossible, especially in a brief review, to give even a general hint as to the character of the contents. This handbook encyclopedia deals with such general subjects as the composition and strength of all kinds of standard and special metals used in machine construction; the important mechanical laws, rules, and principles; condensed descriptions of various classes of manufacturing equipment and processes; applications of a wide range of metal-working machines, special tools, and instruments; information and data relating to various classes of power generating and transmitting apparatus; definitions of technical words, shop, and trade terms; established results and data of practical value to designers and builders of mechanical and electrical apparatus.

This book differs from MACHINERY'S HANDBOOK and other engineering handbooks in that it contains few tables, but consists almost entirely of brief treatises, summaries, explanations, and definitions; hence, the variety of subjects dealt with is proportionately large and includes numerous odd, special items. To illustrate the wide variety of subjects treated, citing just a few examples, suppose you wanted to know what anti-freezing mixtures are particularly recommended for engine radiators; how tolerances should be applied to drawings of machine parts; how to distribute overhead expenses; at what temperature steel is strongest; whether concrete is damaged by freezing, and under what conditions; what "preferred numbers" are, and why their use is advocated; what alloys are commonly used for die-castings; what wage systems are in general use, and how they are applied; in what respect the latest machine screw standard differs from the older ones; what babbitt metal compositions are recommended for heavy, medium or light pressures—by referring to this new handbook you would find the answers to all these questions and to thousands of others of the same general character.

All matter is arranged alphabetically under the headings naturally looked for, and there are cross-references right in the main body of the book, so that a separate index is unnecessary. An alphabetical thumb-index locates the main sections.

New Machinery and Tools

The Complete Monthly Record of New Metal-working Machinery

SELLERS PLANER-TYPE MILLING MACHINE

Planer-type milling machines of various sizes are being added to the line of machine tools built by William Sellers & Co., Inc., Philadelphia, Pa. The machine shown in the accompanying illustrations will take work 64 inches wide between the cutters on the side-heads and 60 inches high between the table and the cutters on the cross-rail heads. It will mill work up to 20 feet long. The bed, table, uprights, and cross-rail are all of heavy construction, providing a rigid support for work and cutters. The machine is not an adaptation of a planer, but is made from entirely new patterns, and is designed to resist the strains encountered in milling rather than those produced in planing.

One of the principal features of the machine is the design of the heads. The heads on the cross-rail and those on the uprights are identical, except for being right- and left-hand. Each head is a complete power unit, having its own 20-horsepower motor drive. This arrangement requires only short shafts and spur gears in the drive. All gears in the heads are made of chrome-nickel steel and are hardened, while the shafts are also made of chrome-nickel steel and are carried in ball or roller bearings, with the exception of the spindle. The spindle quill is 11 inches in diameter and has a 14-inch stroke in and out by power or by hand. The spindle is 6 inches in diameter at the small end of the tapered front bearing, and is made from a chrome-nickel steel forging. At slow speed it is driven by a gear 16 inches in diameter through multiple splines milled on it.

Feeding of the heads is accomplished through an independent motor and a speed reducing box, which are located at the right of the right-hand upright. All head feeds from 1 to 16 inches per minute are conveniently controlled by a field rheostat which enables small variations in the amount of feed to be obtained.

There is a stainless steel scale on each of the heads, graduated in thirty-seconds of an inch. An adjustable pointer moves with the spindle to give accurate readings on the scale. For closer readings, an indicator may be made to move with the spindle quill, and by coming in contact with a block located on a pad on the head, gives readings in thousandths of an inch or less. An independent motor and gear unit provide table feeds ranging from 1 to 16 inches per minute and a rapid traverse of 20 feet per minute. Variations of the table feed are also controlled by a field rheostat and one change of gears.

The provision of separate motors for the feeds is of considerable advantage in milling irregular shapes, as one feed may be started and stopped without interfering with the other, and any combination of head and table feeds may be employed to give any angle of cut required. In milling the edge of irregular castings, such as turbine housings, the operator can vary the feeds to follow around the oval shape by the use of field rheostats and push-button stations, without moving from the operating position.

An auxiliary motor on top of the machine provides a power traverse for the heads and quills.

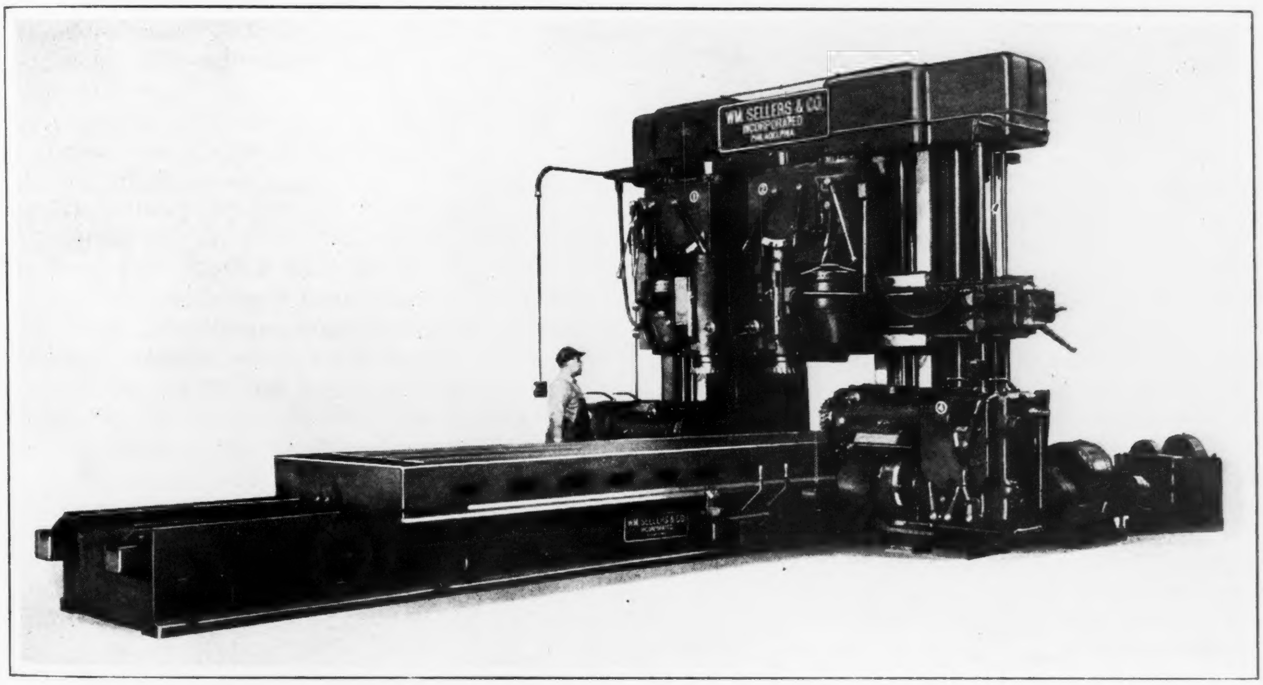


Fig. 1. Sellers Planer-type Milling Machine which is being Brought Out in Various Sizes

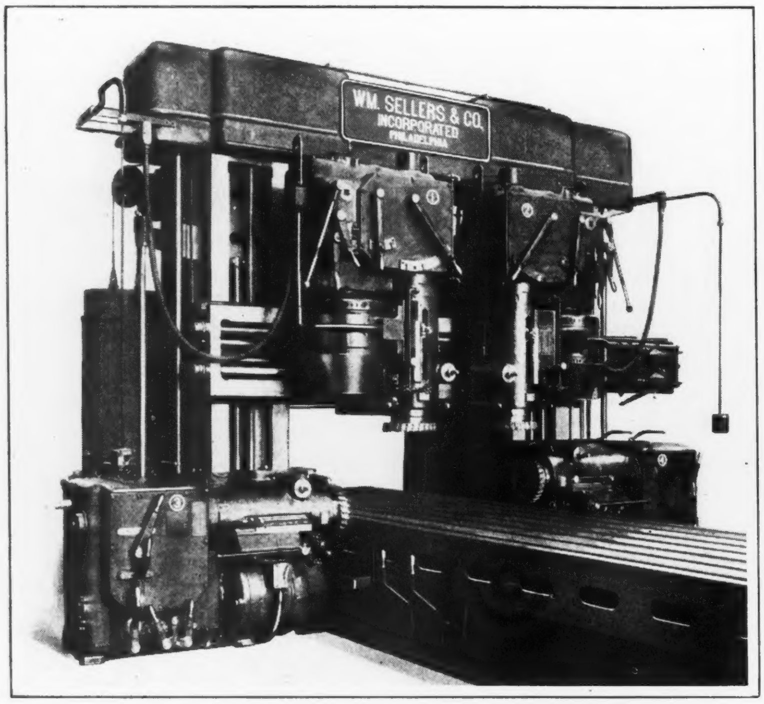


Fig. 2. Four Cutter-heads, Viewed from the Left-hand Side of the Table

Here, again, the machine is arranged for convenience, as one head may be traversed while another is being fed. This motor also raises and lowers the cross-rail. It is located half way between the two uprights, so that there is the same length of shaft running to each lifting screw, insuring steady and accurate operation of the screws.

The cross-rail is of the box type, with the back extended between the uprights, as may be seen in Fig. 3, a construction that has been used on Sellers boring mills and planers for years. The cross-rail slides on the face of each upright and, in addition, has a bearing on a vee at the back. The clamp provided may be operated by a single lever at the right-hand end of the cross-rail. This clamp ties the uprights together, and combines the advantages of a fixed cross-rail with the convenience of an adjustable cross-rail.

The table is carried on one flat and one double V-way. The double vee construction maintains accuracy under the heaviest side cuts. It consists of a flat vee combined with a vee having walls inclined a very few degrees from the vertical. The table bears on the flat vee, except in cases of excessive side pressure, when the upper vee holds the table from moving out of place. When there is no side thrust, the upper vee is clear by a few thousandths of an inch. Holding-down shoes keep the table from lifting during heavy side cuts. The table is driven by a spiral pinion and rack, the pinion receiving power from herringbone gears actuated by the change-gear box. The table is provided with a stainless steel scale and an adjustable vernier giving readings to sixty-fourths of an inch. End thrust on the driving shaft is taken by ball bearings, which are easily adjustable from outside the bed. A supply of oil is continually circulated through these bearings.

The bed is of closed-top construction and is heavily reinforced between the uprights. Inside the bed are located the tanks and pumps with their motors. This feature eliminates piping, which might be in the way and would detract from the appearance of the machine. Particular attention has been given to the arrangement of the lubrication system. Each head has its own pump and circulating system. A pump is also provided in the feed-gear box to insure oil reaching all bearings and flowing over all gears. Forced-feed lubrication is provided for the table ways. The pump of this system is run by a separate motor, so arranged that it must be started before the table-feed motor can be started, thus insuring a supply of oil on the ways before any movement of the table can take place. This pump also insures a continuous flow of oil through the spiral-pinion box and the driving-shaft bearings.

The traverse and lifting mechanism located overhead, which does not require frequent oiling, is lubricated by pumps placed near the operating position, which may be run periodically.

All motors are controlled from one panel and operated by push-buttons located on both sides of the table. Interlocks are provided for the various motions. For instance, the feed motors cannot be started until the cutter motors are in operation. If a 30 per cent overload occurs on any one of the cutter motors, the feed motors will slow down until

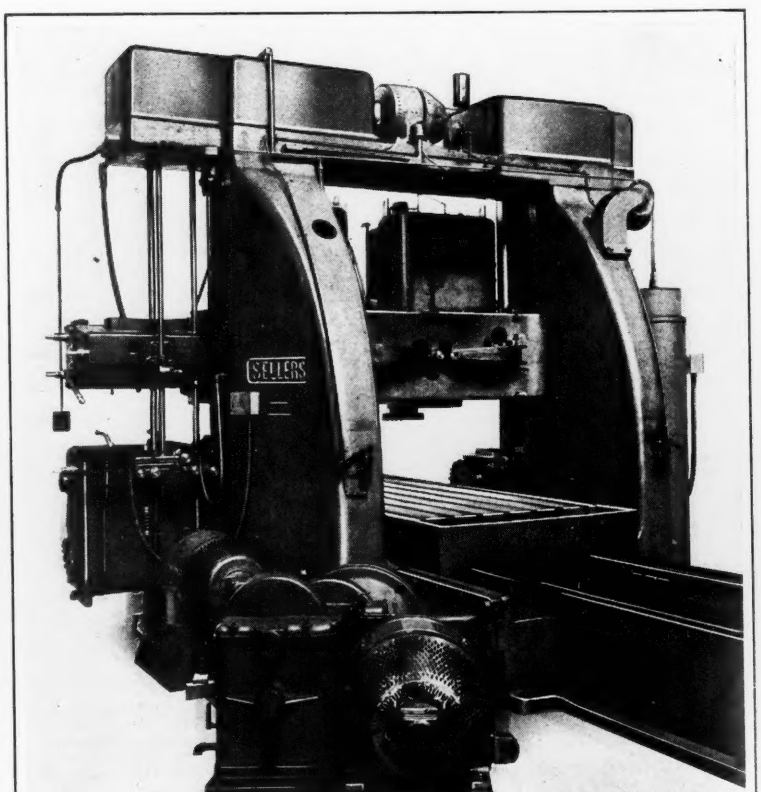


Fig. 3. View of the Sellers Planer-type Milling Machine from the Rear of the Uprights

the load is lessened, when they will automatically speed up again. If a 50 per cent overload occurs on any one cutter motor, the overload relay will stop it and the feed motors will also stop instantly. The slow-down interlock on the feed motors is a valuable feature, as it will insure maximum feeds without injuring the cutters or the machine. In other words, if the operator should try to force the machine beyond the safety point, the electrical interlock will automatically slow it down to its normal capacity. Other interlocks and safety clutches are provided with a view to making the machine as fool-proof as possible.

Provision is made for delivering cutting compound to the cutters and work. The tank for this compound is located in the bed, and has a gage glass on the outside. The pump is driven by a one-horsepower motor, which forces the liquid in pipes through uprights to the top of the machine. From there it runs through pipes and flexible connections to each of the heads. An adjustable frame and two nozzles are provided for each cutter. As the cutting compound drains off the work it runs to the end of the table and passes through strainers into a trough running the full length of the bed, which returns the compound to the tank.

MILLHOLLAND MULTIPLE-UNIT GEAR DRILLING MACHINE

Six columns supporting six separate automatic drilling units equipped with three-spindle indexing heads are embodied in a gear drilling machine recently built by the Millholland Sales & Engineering Co., 1833 Ludlow Ave., Indianapolis, Ind. This machine is designed for drilling fourteen 7/32-inch holes in the face of automobile transmission gears. Accurate spacing of the holes and increased output over former methods are advantages of the equipment, as well as a floor space reduction of 50 per cent. The six units are tended by one operator, the machine being timed to allow the operator exactly enough time to keep the machine in full production.

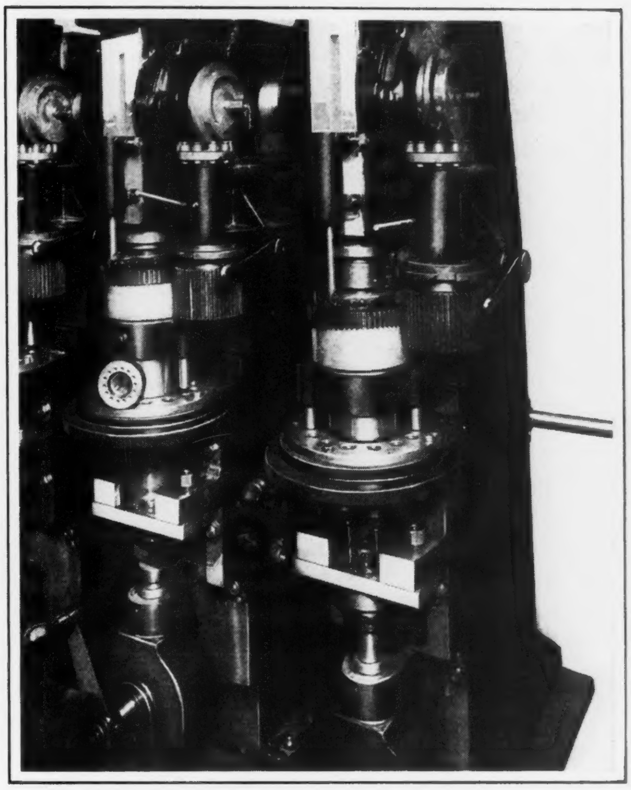


Fig. 2. View Showing the Indexing Mechanisms and Clamping Fixtures of Two Units

The basis of the machine is the Millholland automatic drill unit, provided with several features, such as automatic indexing of the drill spindles, automatic index "cut-out" when the cycle of five indexings has been completed, and clamping fixtures that can be reloaded rapidly.

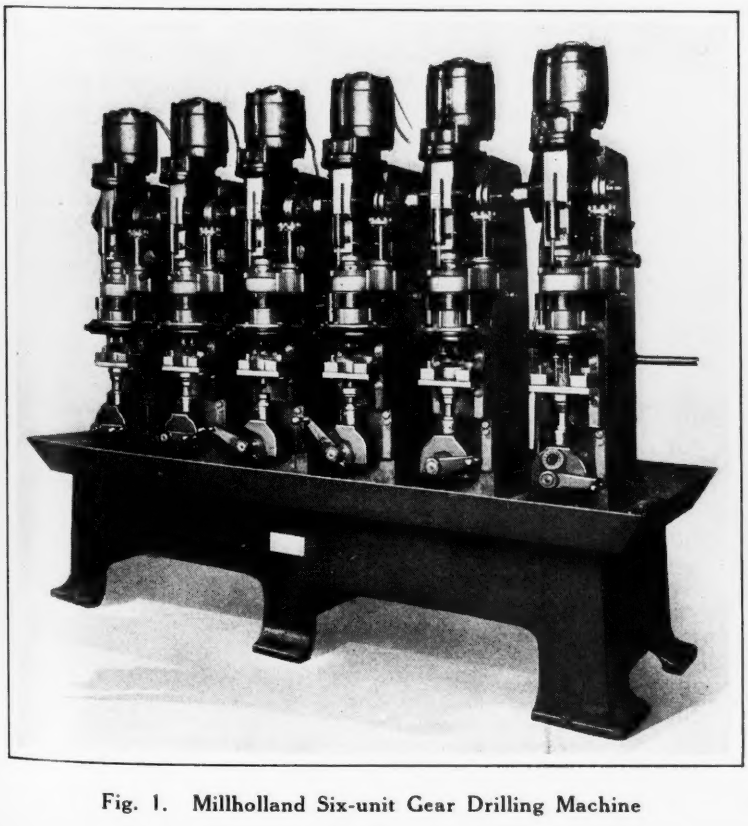


Fig. 1. Millholland Six-unit Gear Drilling Machine

Fig. 2 shows a close-up view of the indexing mechanisms and fixtures of two units. Mounted on the extension of the feed camshaft seen on each of these units near the top, there is a "switch back" index cam which comes in contact with rollers mounted on the end of the corresponding vertical indexing spindle. As the feed camshaft completes one revolution for drilling three holes in the work, the roller in contact with the index cam is moved to the next station, bringing a new roller into contact with the cam.

Accurate alignment of the drill spindles with the holes in the drill jig is insured by two guide pins, which travel in hardened bushings mounted in a plate on a bracket that is fixed to the column. A large hardened bushing in the center of this plate acts as a bearing for the drill head body. On the return stroke of the spindles, the guide pins withdraw from the bushing plate, so as to permit the head to index.

Indexing of the drill-head spindle is accomplished through a wide-faced gear actuated by the indexing cam. This gear meshes with a large gear on the drill head,

which is free to rotate when the spindle is at the top of its stroke. Immediately above the wide-faced gear is a collar with a notch in it which allows the feed-cam trip to operate after the spindle has completed five drilling and indexing cycles.

The work-holding fixtures are of the cam-and-plunger type. The main body of each fixture is an integral casting, which also carries the drill jig and the guide-pin index-plate. The operation of this machine is flexible, as any unit may be stopped in order to change drills without interfering with any other. Each unit has a separate control. A motor-driven pump delivers coolant from a tank at the rear of the machine.

EKSTROM-CARLSON SPECIAL AUTOMATIC MACHINES

Four automatic machines developed for special purposes, but which are adaptable to a variety of work, have been recently built by Ekstrom, Carlson & Co., 1439 Railroad Ave., Rockford, Ill. The

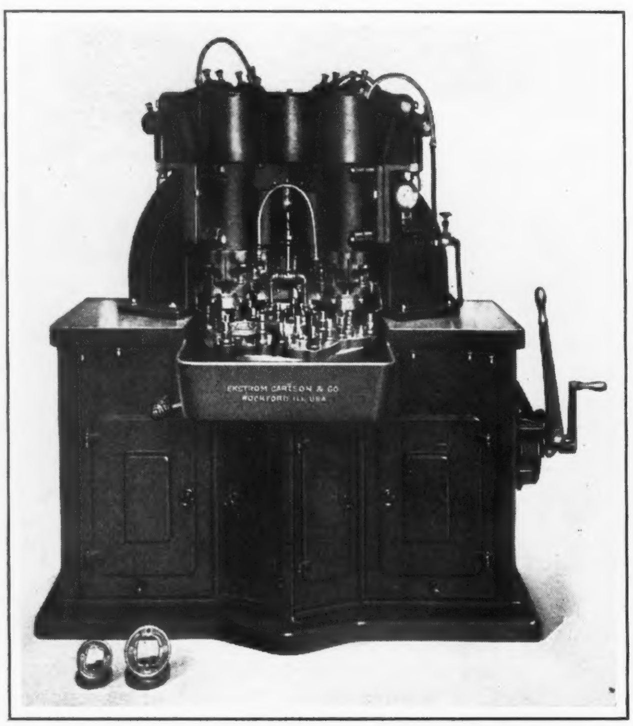


Fig. 1. Ekstrom-Carlson Special Automatic Radius- and End-milling Machine

radius- and end-milling machine shown in Fig. 1 is designed for machining universal-joint housings of different sizes. This machine has six stations and four cutter-heads. Each head operates independently, but all four heads work at the same time. The two extra stations on the table are for loading while the four cutter-heads are operating.

A force-feed pump carries oil to all working parts of the heads under a pressure of 10 pounds. The machine is also equipped with a pump that delivers oil or cutting compound to the work. All cams run in an oil bath inside the housing. This machine has a capacity for machining five housings per minute, milling four radii and end-milling four surfaces on each housing, making a total of eight operations with each feeding movement. The machine is motor-driven.

In Fig. 2 is shown an automatic threading ma-

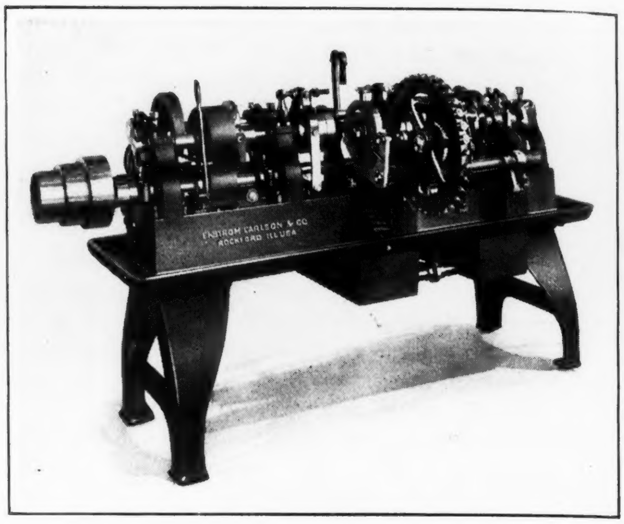


Fig. 2. Automatic Threading Machine Built by Ekstrom, Carlson & Co.

chine designed for threading both ends of standard automobile parts. The parts are placed on the loading wheel, and the machine automatically takes care of the threading. A feeding arm places the parts on an index-wheel which carries the work to the threading heads. These heads are automatically moved forward the required distance, released, and returned to their respective starting positions ready for the next in-feed. The finished part is removed automatically by the same arm that places parts on the index-wheel. Four of these machines can be tended by one operator. Each machine produces eight parts per minute, or in other words, cuts sixteen threads, giving a production of sixty-four threaded ends per minute for four machines.

The automatic hollow milling machine shown in Fig. 3 is designed for turning or hollow-milling two ends of trunnions, such as are used in universal joints. These parts are placed on the loading wheel by the operator, who takes care of eight machines. The parts are automatically removed from the loading wheel by an arm, which places them on an indexing wheel by which they are positioned ready for the forward movement of the opposed cutter-heads.

A steady stream of oil is carried to the work through the hollow spindles. After the machining

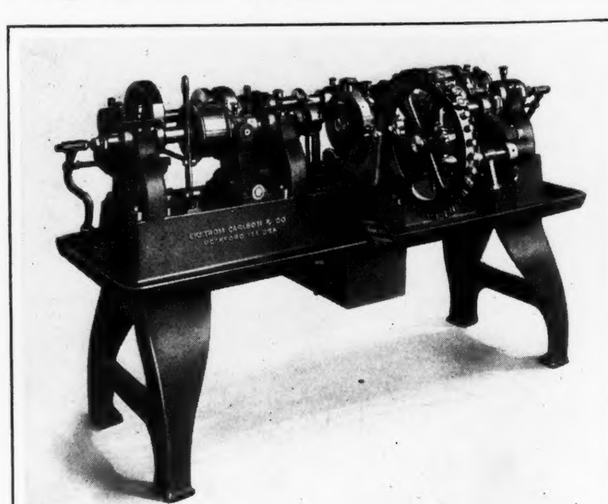


Fig. 3. Machine for Automatically Hollow-milling Universal-joint Trunnions

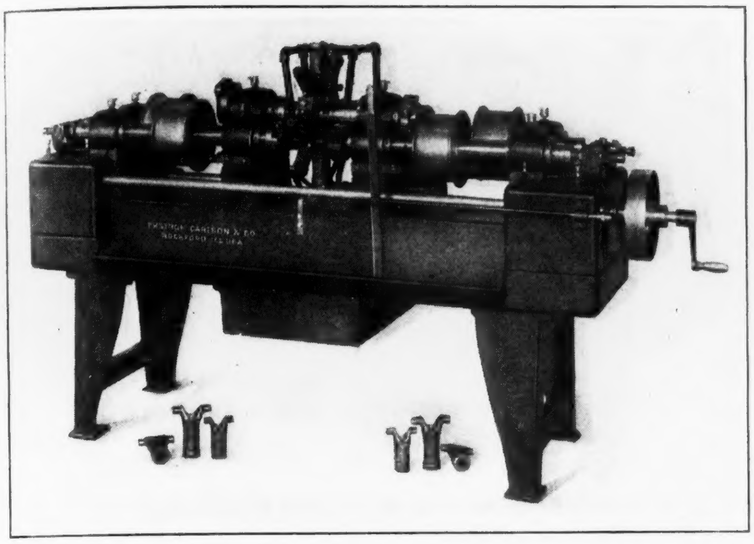


Fig. 4. Automatic Machine for Finishing Ends of Universal-joint Yokes

operation has been completed and the tools have been withdrawn, the parts are removed by the same arm that places them on the index-wheel. One machine completes four pieces per minute.

The automatic turning machine shown in Fig. 4 is intended primarily for turning universal-joint yokes, but can be adapted for any work where turning is required on both ends of a part. As in the case of the machines previously described, this machine operates automatically. Four machines can be cared for by one operator. The yokes are simply placed on an index-wheel, which carries them to the operating position in which the rough-turning is done. A second indexing movement carries the work into position for finish-turning. Yokes are finished at the rate of three per minute.

SOCIETE GENEVOISE TWO-COORDINATE MEASURING MACHINE

A machine intended for accurately measuring gages, cams, templets, parts of instruments (such as watch or clock plates) steel scales, recording instrument tracings, photographic prints, etc., is the latest addition to the line of measuring machines built by the Société Genevoise d'Instruments de Physique, Geneva, Switzerland. This machine has been placed on the American market by the R. Y. Ferner Co., Investment Building, Washington, D. C. Objects to be measured are placed on the table, which is moved along the bed by revolving a micrometer screw. A microscope carried on an overhead slide is moved across the table by means of another micrometer screw. In taking measurements, the object is sighted through the microscope, which has a reticle of parallel or crossed spider threads in the field of view.

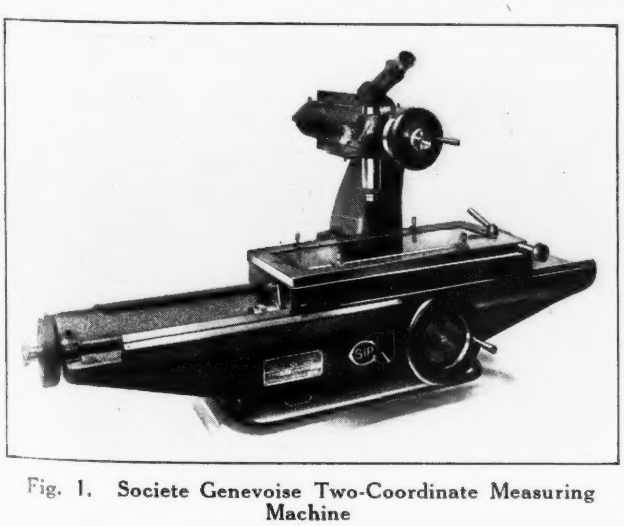


Fig. 1. Societe Genevoise Two-Coordinate Measuring Machine

By providing a semi-automatic center-punch device and replacing the glass plate of the table with a metal plate, the machine can also be used for laying out any irregular curves of which the coordinates are known; or for locating holes in master plates or jigs as large as 16 by 4 inches.

The table is mounted on vee and flat ways, and has a longitudinal movement of 16 inches, while the micrometer slide has a crosswise movement of 4 inches. The top table member in which the glass plate is mounted is pivoted at one end and has numerous

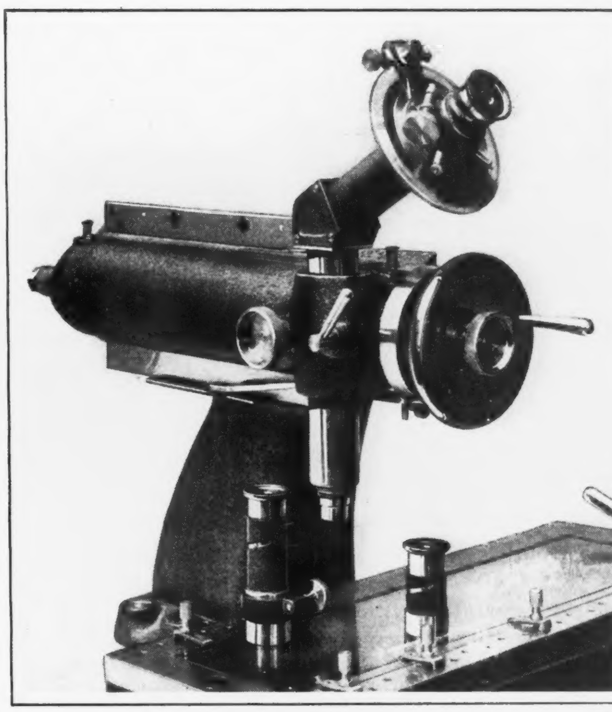


Fig. 2. Goniometric Eye-piece for Measuring Angles with the Machine Shown in Fig. 1

holes to receive spring clamps by which photographic plates, etc., are held while taking measurements. A micrometer screw, scale, and clamp are provided at the right-hand end of the member that holds the glass plate, by means of which the axis of the work can be brought into alignment with the line of table travel and the amount of adjustment measured. An opening in the rear of the machine base permits a beam of light to be thrown upward, through the rectangular opening under the glass

The micrometer head of the table lead-screw is located at the left-hand end of the machine base. However, the lead-screw is rotated by means of a handwheel at the front of the bed which actuates helical gears that cause the screw to make one turn for every two turns of the handwheel. Errors in the micrometer screw are automatically compensated for by means of a templet attached to the

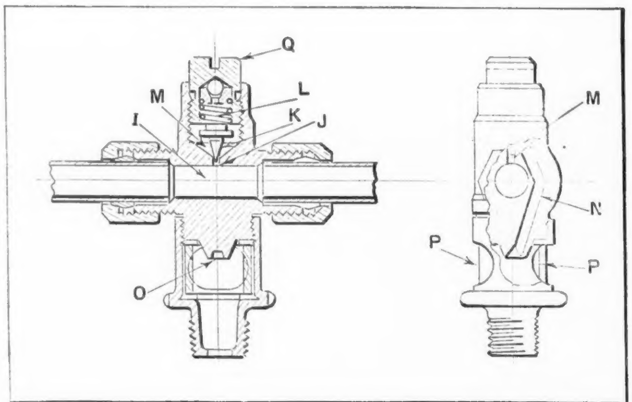


Fig. 1. Sight-feeder of Blanchard Pulsating System for Oil Lubrication

rear edge of the movable table and a lever system which transmits to the micrometer head the movements of a steel pin that follows the contour of the templet. The accuracy of the compensating templet can be checked at any time by taking readings on a standard scale placed on the table.

The lead-screw of the cross-slide on which the microscope is mounted is provided with a similar arrangement, which automatically compensates for errors in this screw. This system of compensation makes it possible to guarantee that errors of direct readings will be less than 0.0001 inch at any point. The micrometer heads of the lead-screws are graduated to 0.0005 inch, and the verniers to 0.00005 inch.

The microscope can be focussed by means of a rack and pinion, and is provided with a clamp for holding the settings. Two objectives and three eye-pieces are regularly provided, which meet all ordinary requirements. In addition, the goniometric eye-piece shown in Fig. 2 is supplied for use in measuring the angle of any corner of a small part. This eye-piece has one fixed spider-thread line and one line that can be rotated through 360 degrees. The graduated circle on the movable member and its vernier permit the reading of angles to one minute of an arc.

BLANCHARD PULSATING SYSTEM FOR OIL LUBRICATION

A new oiling system applicable to machine tools and production machinery in general is being placed on the market by the Rivett Lathe & Grinder Corporation, Brighton District, Boston, Mass. Among the more important advantages claimed for this new system are: Complete automatic operation; full visual indication of amount of oil in reservoir and rate of positive feed to each individual bearing; economy of application obtained through use of single-loop oil line; and complete and accurate control of feed at each bearing.

The system consists essentially of a pump enclosed in an oil reservoir, a distributing pipe with adjustable sight-feeders for individual bearings, and a pressure control valve which causes sudden pressure impulses of high intensity in the flow of oil. These pressure impulses prevent clogging and permit the individual feeders to be adjusted to supply any predetermined amount of oil from two or three drops per hour to practically a continuous stream. The complete equipment, known as the "Blanchard Pulsating System," is the result of five years' development work of the company's engineers, under the direction of Frederick C. Blanchard, who has had wide experience in the design and application of oil-feeding devices.

The pump is of the two-cylinder plunger type, with piston valves that are positively driven from the main shaft. There are no ball or check valves. The ground and lapped steel plungers will carry through, or cut through, any ordinary dirt, sludge, or sediment without damage to the mechanism. The oil intake is through a fine screen of large area, which is easily accessible for cleaning. This screen, in addition to the screen at the filler opening in the three-quart reservoir, gives double filtering of the oil. Referring to Fig. 2, the pump shaft *A* may be driven by belt or gearing from any convenient rotating shaft or member of the machine. The drive may be in either direction or reversing, and at a speed of from 75 to 125 revolutions per minute.

The pump delivers a stream of oil greatly in excess of the requirements of the bearings. The

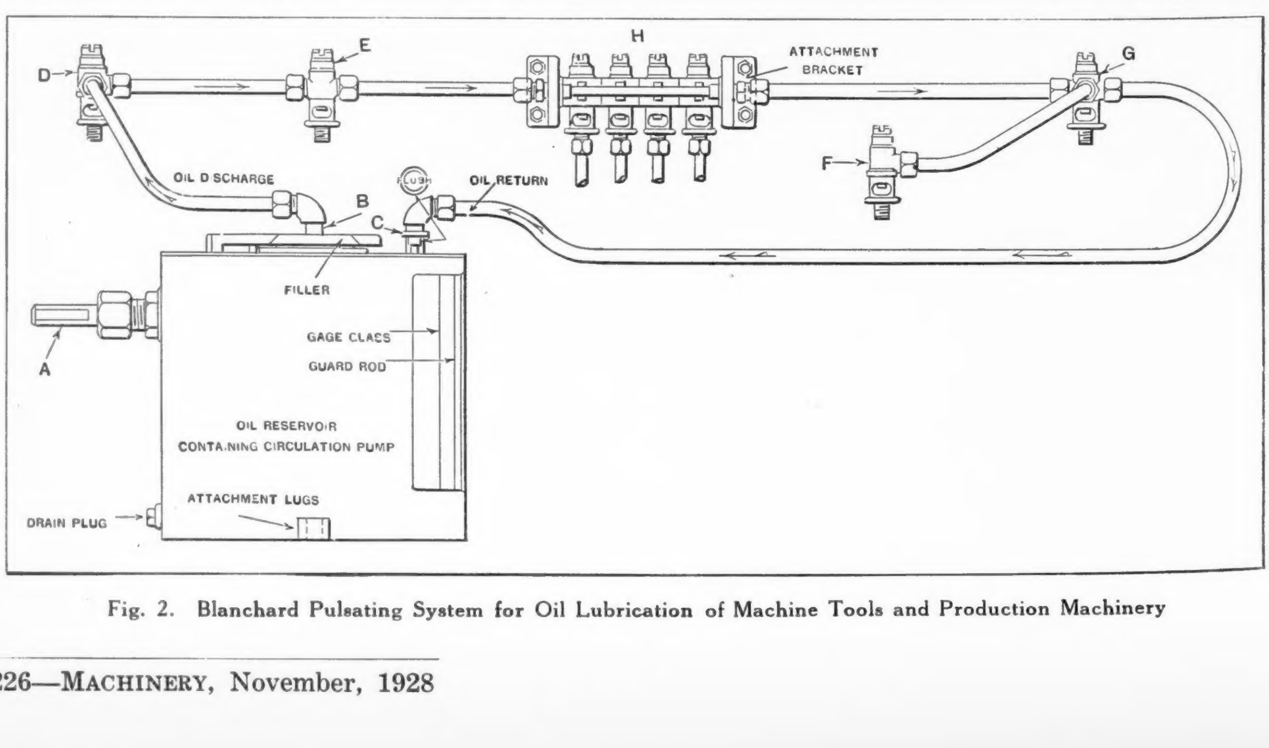


Fig. 2. Blanchard Pulsating System for Oil Lubrication of Machine Tools and Production Machinery

oil enters the pipe at B and makes a complete circuit of the single pipe line, the excess returning to the pressure control valve in the reservoir. This valve is of the rotating plate type, and is driven by a worm and gear from the pump shaft, being closed once in every fifteen revolutions of the pump and remaining closed about 5 per cent of the time.

When the valve is opened, the oil circulates freely through the pipe line under the slight pressure required to overcome the friction developed in passing through the pipe. When the valve is closed, the oil is delivered against a simple pressure relief valve which gives a short pulsation of pressure or "kick" of sufficient intensity to operate the needles in the feeders.

Button C, marked "flush," is connected with the moving part of the relief valve, and moves upward or "jumps" at each pressure pulsation; being located at the return end of the oil line, it provides a definite visual indication that the oil is circulating properly. By pressing this button down, the spring in the relief valve is heavily loaded and the pulsation pressure increased about threefold, thus bringing about a corresponding increase in the amount of oil fed to each bearing. This feature is an advantage when a machine that has been idle for some time is started up.

Any number of individual feeders, such as shown at D, E, F, and G, can be inserted in the pipe line, in addition to one or more multiple feeders, such as shown at H. The feeders are all of the same internal construction, but are made in the elbow, straightway, side-outlet and dead-end types, as indicated, to facilitate the installation of the system. The multiple feeders H are employed for a close group of bearings or hidden bearings, and can be made up in gangs of from two to twelve feeders.

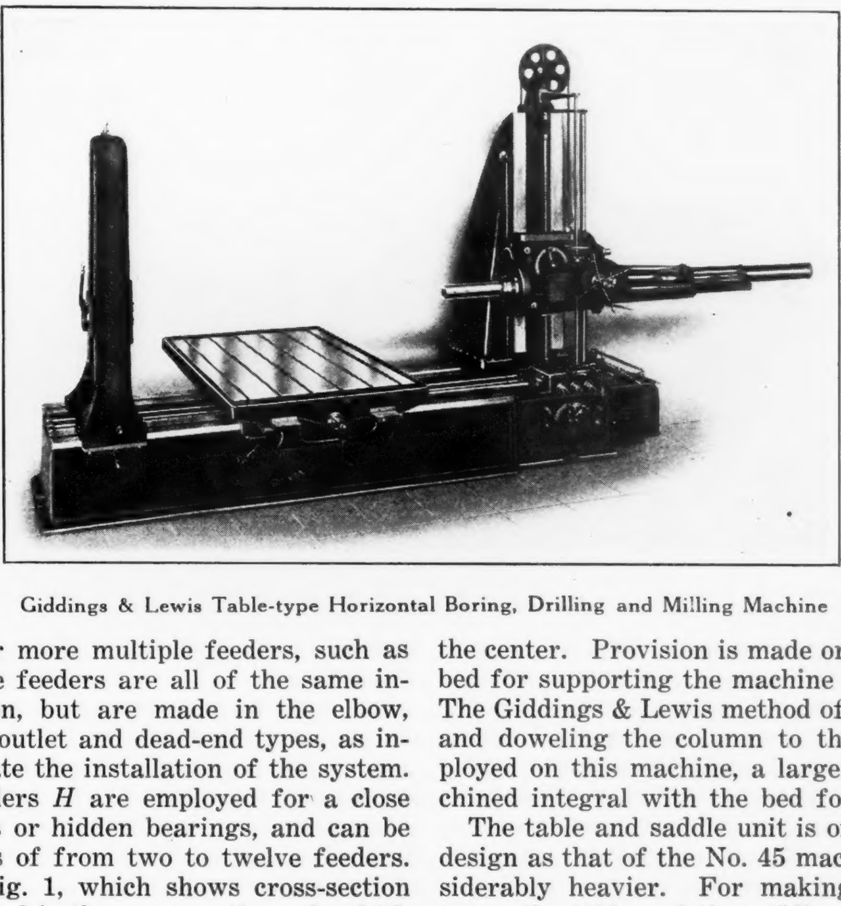
Referring to Fig. 1, which shows cross-section views of a feeder, I is the passage through which the oil circulates under a low pressure, except when the pulsation occurs. This momentary increase in pressure, acting through passage J, is sufficient to lift needle K from its seat against the adjustable loading pressure of spring L, so that oil is admitted to the chamber M.

Upon the passing of the pulsations, the needle instantly recedes. The oil collected in chamber M flows down through the passage N and drips off the nozzle O, which is visible through the glass in the openings P. By turning the adjusting screw Q to the left, the load on the spring L is lessened, so that the needle K is raised higher, thus allowing more oil to enter the chamber M. Right-hand rotation of the screw decreases the rate of feed.

Danger of clogging of the feeders is lessened by the pulsating or jumping movement of the needle valve, which overcomes any tendency on the part of the oil to film over the feed opening. This opening is above the column of oil, and is thus safeguarded against the entrance of foreign matter which is carried through the pipe line to the reservoir, where it is filtered out. During the last two years, test sets of the pulsating system have been in operation in various plants without developing any defects. The system is, in fact, automatic, the only attention required after installing and adjusting the feeds being the filling of the reservoir.

GIDDINGS & LEWIS HORIZONTAL BORING, DRILLING AND MILLING MACHINE

Increased range and capacity are the principal features of the new No. 50 table-type horizontal boring, drilling, and milling machine recently developed by the Giddings & Lewis Machine Tool Co., Fond du Lac, Wis. To properly distribute loads involved in the handling of large work, the bed is of solid box-type construction, the weight of the standard bed unit alone being 15,000 pounds. The ways are 13 inches wide and measure 48 inches over the outer edges, being relieved in the center. Provision is made on the bottom of the bed for supporting the machine on leveling blocks. The Giddings & Lewis method of bolting, tonguing, and doweling the column to the bed unit is employed on this machine, a large tongue being machined integral with the bed for this purpose.



Giddings & Lewis Table-type Horizontal Boring, Drilling and Milling Machine

The table and saddle unit is of the same general design as that of the No. 45 machine, but it is considerably heavier. For making adjustments between the table and the saddle, two taper gibs are provided, one at each end. The screw for effecting the cross-feed of the table is mounted in ball bearings and is arranged with adjustable graduated dials on each end. The Bowen system of lubrication is standard equipment for oiling all ways, gears, and bearings of this unit. One stroke of the plunger supplies lubricant to all parts, regardless of the table position.

The main casting of the spindle head is made in one piece to furnish a solid support for all moving parts of that unit. It is of compact design and permits close observation of small work. Automatic lubrication is provided, a constant flow of

oil being furnished to all parts by a positive driven pump in the head.

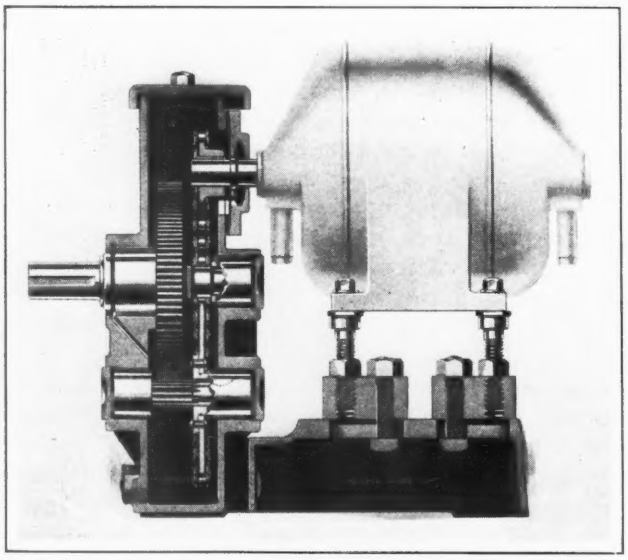
Twenty-four spindle speeds in either direction and eighteen feeds are obtainable through sliding gears and jaw clutches contained in separate units mounted on the bed and running in oil. The speeds range from 5 to 245 revolutions per minute. Changes in speed and feed are accomplished through levers that are easily accessible.

Power is furnished to the machine through two "Twin-Disc" friction clutches, which arrangement makes the machine particularly adapted for tapping operations. A gear-change quadrant is included in the gear-feed train, so that positive leads can be had for tapping and threading. This machine can also be supplied with the G & L precision measuring device. Some of the principal specifications of the machine are as follows: Longitudinal travel of spindle, 64 inches; vertical adjustment of head on standard column, 64 inches; working surface of table, 60 by 96 inches; maximum distance from face of spindle sleeve to end support with standard bed, 120 inches; cross-travel of 60- by 96-inch table, 86 inches; and approximate weight of machine, 45,500 pounds.

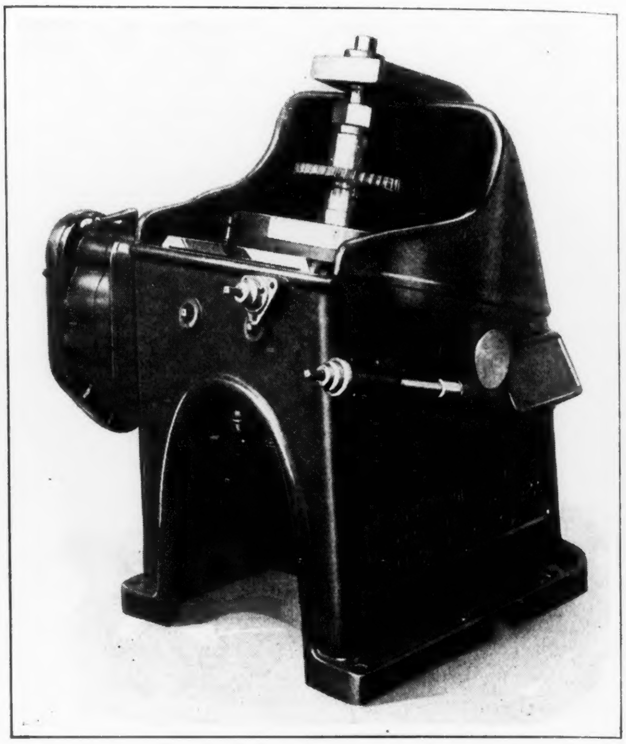
CULLMAN SPEED REDUCERS

Seven sizes of speed reducers for motors from 1/4 to 5 horsepower have recently been placed on the market by the Cullman Wheel Co., 1339 Altgeld St., Chicago, Ill. These devices are designed to reduce or step down the high speed of electric motors to the speed required for operating machines or for special purposes. The various sizes cover a range of speed reductions from 6 to 1 to 1015 to 1.

Motors and reducers are built as one unit, the motor being mounted on four adjustable studs, as indicated in the accompanying illustration. This feature facilitates obtaining alignment and proper adjustment for the chain drive. The chain and sprocket drive for the first speed reduction also acts as a flexible coupling between the motor and the reduction gears. All working parts of the speed reducers operate in an oil bath. The gears and sprockets are made of steel, and hardened.



Cullman Speed Reducer with Motor Assembled on Base



Oesterlein Tilted Offset Miller for Machining Screws, Bolts, Clevises, and Other Small Parts

OESTERLEIN TILTED OFFSET MILLER

A 28-inch tilted offset miller recently brought out by the Oesterlein Machine Co., 3315 Colerain Ave., Cincinnati, Ohio, incorporates the same general principles of offset milling as the 48-inch machine built by this concern. The 48-inch machine was described in September, 1927, MACHINERY, page 35. Relatively large cutters, completely surrounded with work, the centers of the cutters and work being offset from each other so as to obtain the proper depth of cut, form the basis around which the design of these machines has been developed. Among the advantages particularly pointed out for this method of machining parts are the following: The cut is continuous, there being no returning to the starting point; a number of parts are machined at the same time; and the feed automatically decreases at the bottom of the cut.

The new 28-inch machine is intended for use in flatting the head of connecting-rod bolts, slotting screws, milling small clevises and yokes, sawing operations, and straddle- and face-milling small parts. Because production on such work is limited in the "Offset" process only by the number of parts that an operator can handle, means are provided in the work-holding fixtures for automatically clamping, unclamping, and ejecting the parts, thereby leaving the operator free to devote his entire time to loading.

Provision is made for delivering 20 gallons of coolant per minute to the cutter and work. Other features of the design include a large chip basin in the base; frictionless bearings throughout; a lubrication system that requires little attention; and adaptability to the use of automatic fixtures. The machine has a table 18 inches in diameter and swings work up to 28 inches in diameter. The distance from the table to the outboard arbor bearing is 14 inches. The machine weighs 2600 pounds.

Grand Rapids Surface Grinder Provided with an Oilgear Feed

GRAND RAPIDS HYDRAULIC-FEED SURFACE GRINDER

There has recently been added to the line of grinding machines built by the Gallmeyer & Livingston Co., 344 Straight Ave., S. W., Grand Rapids, Mich., a No. 5 surface grinder equipped with an Oilgear hydraulic feed. Except for its larger size, this machine is similar to the No. 4 hydraulic surface grinder built by the same company, which was described in September, 1927, MACHINERY, page 33. With the Oilgear mechanism, an infinite number of feeds, ranging from almost nothing to 55 feet per minute are obtainable by merely turning a handle on the front of the base.

The Oilgear mechanism is connected to a cross-feed mechanism under the saddle, the arrangement being such that with each reversal of the reciprocating table the cross-feed mechanism is actuated. The cross-feed mechanism may be set to operate at each end of the reciprocating table stroke or at one end only, and to feed either in or out. The amount of cross feed for each reciprocation of the table is also adjustable.

Another important feature of the machine is the method of raising and lowering the wheel-head. By turning a large handwheel, the head can be rapidly raised or lowered a considerable distance. This gives a direct action through worm-gearing to the elevating screw. The handwheel is graduated to 0.00025 inch, and has a movable pointer which can be set to enable readings to be conveniently made.

However, when it is desired to obtain very accurate readings for grinding to close limits, the smaller handwheel or knurled hand-knob in the center of the large handwheel is turned. This gives a back-gear action to the elevating mechanism. The disk in the center of the handwheel has a graduated dial-ring which can be easily set to zero in relation to the pointer mounted on the spoke of the large handwheel. Both the inner and outer wheels turn, but the graduations on the inner wheel are arranged to give a vernier effect, in combination with the moving pointer. By this means, it is easy to obtain adjustment readings to 0.0001 inch from graduations over 1/8 inch apart. One-thousandth of an inch is represented by spaces on the graduated dial almost 1 1/2 inches long.

Some of the important specifications of this machine are as follows: Longitudinal and transverse automatic table travel, 38 and 12 inches, respectively; working surface of table, 10 by 36 inches; vertical movement of wheel-head, 13 3/4 inches; maximum distance from wheel to table under 10- and 7-inch wheels, 12 1/4 and 13 3/4 inches, respectively; and weight of motor-driven dry-grinding machine, without accessories, 4250 pounds.

WESTINGHOUSE ARC-WELDING SETS

Three new arc-welding sets have recently been developed by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. The 300-ampere "direct-current" arc-welder shown in Fig. 1 was designed for heavy-duty work and continuous service in shops and in the field where only direct current is available for the motor.

The driving motor and the generator are enclosed in the same frame, and the control, which is protected by a sheet-steel cabinet, is mounted on the top part of the frame. For use as a portable unit, three roller-bearing wheels are attached to the frame as shown. The driving motor can be used on either a 230- or a 550-volt line. Any desired welding current over the entire range of from 75 to 400 amperes can be readily obtained by the proper setting of the one-dial rheostat.

Another direct-current arc-welding set, similar in appearance to the one just described, but rated at 200 amperes, has been developed recently by the same company. This welder is also particularly adapted for use in plants and railway shops where only direct current is available for operating welding sets. Either a 230- or 550-volt driving motor

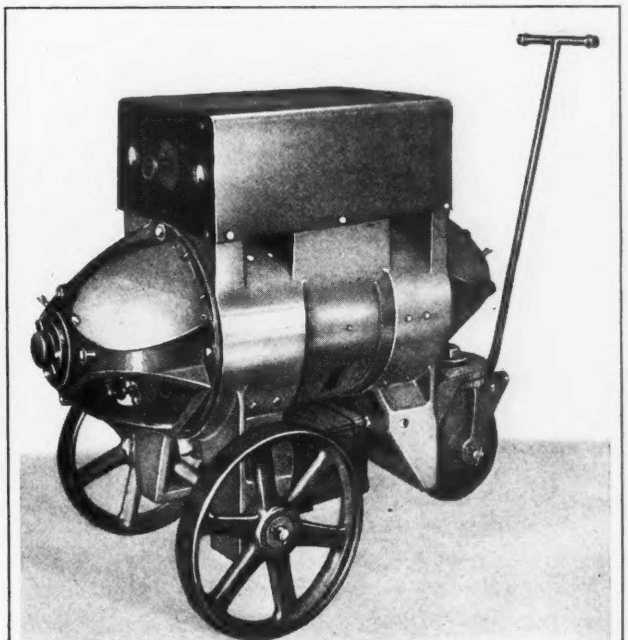


Fig. 1. Westinghouse Heavy-duty 300-ampere Arc Welder

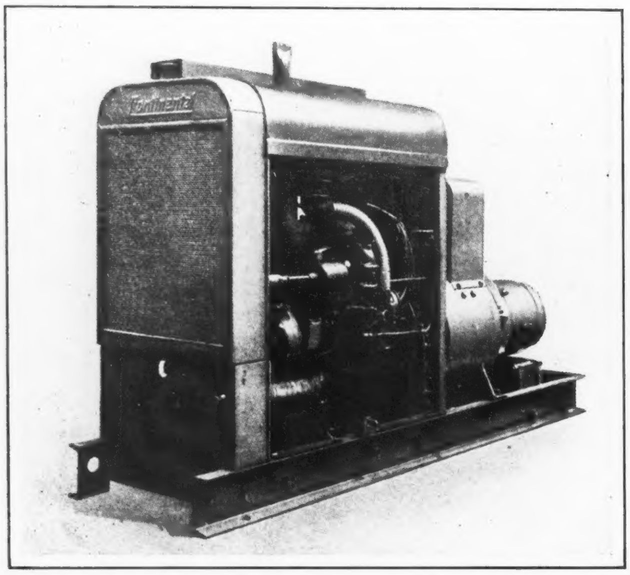


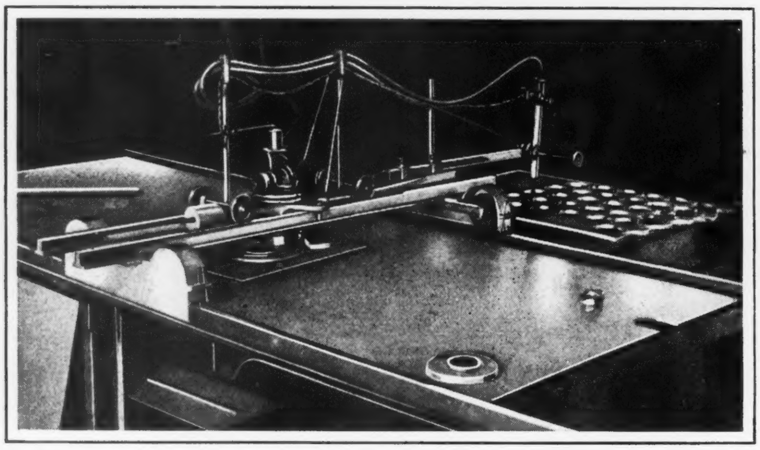
Fig. 2. Gasoline-engine Driven Welder Built by the Westinghouse Electric & Mfg. Co.

may be used. The welding range of this set is from 60 to 300 amperes.

In Fig. 2 is shown a self-contained gasoline-engine driven arc-welding set designed particularly for pipe line construction, structural steel work, railroad construction, and general welding service in isolated places where current from electric power lines is not available. This set consists of a model P-20 Continental gasoline engine, direct-connected to a new type Westinghouse 200-ampere arc-welding generator, with a direct-connected exciter overhung from the generator bracket. The four-cylinder engine has a rating of 24 brake horsepower at 1450 revolutions per minute, and will operate under a normal load for eight hours on 10 gallons of gasoline. The welding range of the equipment is from 60 to 300 amperes.

"OXWELD" SHAPE-CUTTING MACHINE

Automatic oxy-acetylene equipment designed to cut shapes of any sort from steel plate, sheet metal, forgings, billets, or ingots is being placed on the market by the Linde Air Products Co., 30 E. Forty-second St., New York City. In this machine a cutting blowpipe is mounted on a carriage, which is moved in any direction by an electric motor drive. For routine production, the carriage is guided automatically by means of templets. In cases where only a few parts are to be cut out, a hand tracing device can be attached and used to follow the outline of a sketch or blueprint.

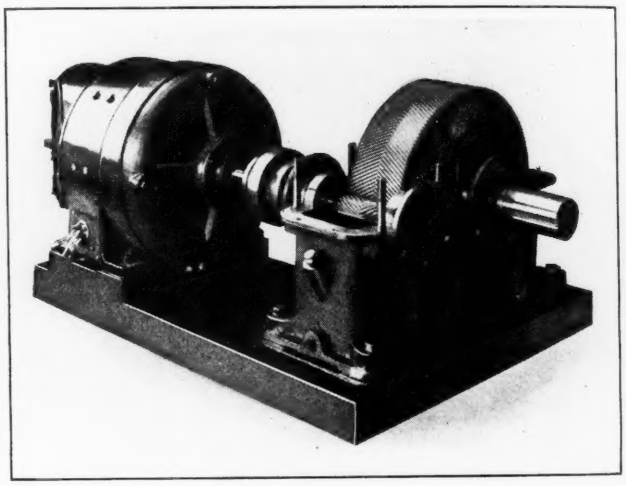


"Oxweld" Oxy-acetylene Shape-cutting Machine

The machine requires but one operator. In most cases the parts produced have straight corners and smooth faces, so that but little machining is necessary. The cutting speed ranges from 3 to 20 inches per minute, depending on the thickness of the metal. Accurate and smooth cuts can be made in stock more than 12 inches thick.

FARREL-SYKES ROLLER-BEARING TYPE SPEED REDUCERS

A new series of speed reducers having Sykes continuous-tooth herringbone gears and roller bearings that carry both radial and thrust loads are being placed on the market by the Farrel-Birmingham Co., Inc., 344 Vulcan St., Buffalo, N. Y.



Farrel-Sykes Speed Reducer Mounted on Base with Driving Motor

The new speed reducers are made in both single- and double-reduction types, in sizes ranging from 1 to 5000 horsepower. Farrel-Sykes continuous-tooth herringbone gears, such as are used in the reducers, may be obtained in sizes ranging from 1/4 inch in diameter, 16 diametral pitch and 5/8 inch face width, up to 240 inches in diameter, 3/4 diametral pitch and 54 inches face width.

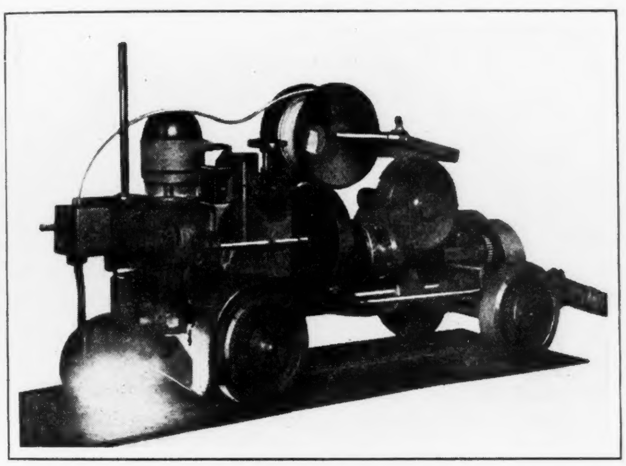
It is claimed that end float of shafts is eliminated in the new reducers and that, therefore, the gears are protected from damage sometimes caused by the mechanisms with which the reducers are connected. It is also claimed that the mechanical efficiency is from 98 1/2 to 99 per cent for a single reduction, and from 98 to 98 1/2 per cent for a double reduction. The lubrication problem is simplified in this type of reduction, as the same oil may be used for the gears and the bearings. This makes it possible to use the splash and flood automatic system of lubrication. As the roller bearings are interchangeable, the gear units can also be interchanged.

In the accompanying illustration is shown a single-reduction unit mounted on a common baseplate with the driving motor. This series is designed for ratios between 2 to 1 and 10 to 1, and for transmitting from 3 to 300 horsepower.

LINCOLN AUTOMATIC TRACTOR TYPE WELDER

An automatic tractor type arc welder, which operates on the "electronic tornado" principle and is intended for use in making lap and butt welds on large tank bottoms and roofs, large pipe, and similar work, has been placed on the market by the Lincoln Electric Co., Coit Road and Kirby Ave., Cleveland, Ohio. The machine, here illustrated, consists of an "electronic tornado" head mounted on a self-propelled four-wheel-drive carriage.

Power is supplied through a flexible cable, so that it is only necessary to line up the machine over the seam to be welded and to start the arc, after which the electrode and fibrous autogenizer are fed automatically as the tractor travels forward. In making lap welds, no additional filler metal is used. The heat of the carbon arc fuses the edge of the top plate with the lower plate, making a leak-proof joint. A filler strip is laid over

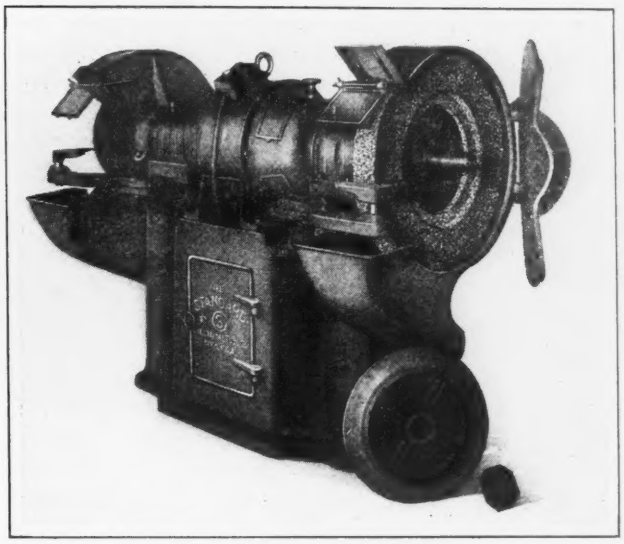


Lincoln Tractor Type Welder

the seam to be welded when a butt weld is desired. The chief advantages claimed for this machine are high welding speeds and smooth uniform welds. The welding speed on 1/4-inch lap joints varies from 50 to 75 feet per hour.

HEAVY-DUTY SNAGGING GRINDER

A heavy-duty motor-driven snagging grinder, somewhat similar to the machine described in July, 1927, MACHINERY, page 870, has recently been added to the line manufactured by the Standard Electrical Tool Co., 1938-46 W. Eighth St., Cincinnati, Ohio. However, the new machine is designed for use with rubber-bonded wheels, and is arranged with flanges and wheel centers. These grinders are built in 5-, 7 1/2-, and 10-horsepower sizes, to take ring wheels from 18 to 30 inches in diameter. They are intended for high-speed operation. The 7 1/2-horsepower grinder, shown in the accompanying illustration, is equipped with 24- by 3-inch rubber-bonded wheels having a 12-inch bore.



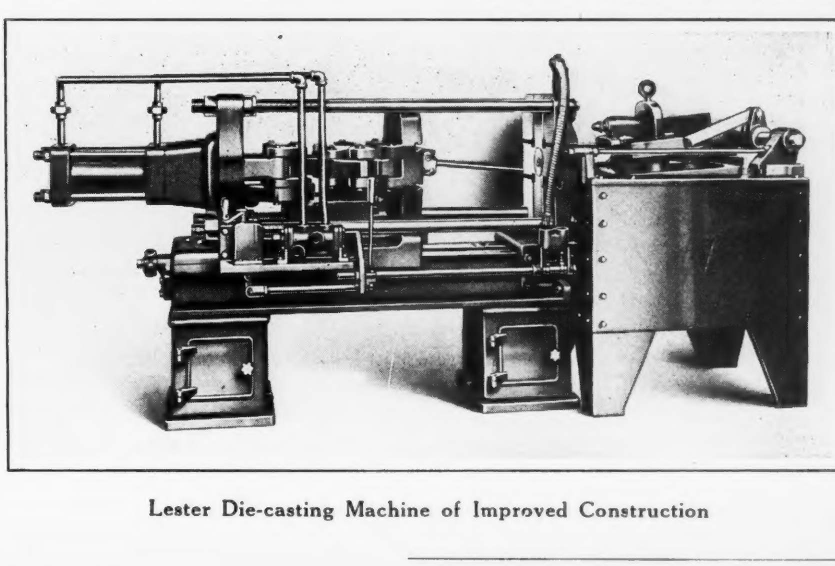
Heavy-duty Snagging Grinder Made by the Standard Electrical Tool Co.

The grinding wheel flanges are 12 inches in diameter, and the inner flange is keyed to the nickel-steel one-piece armature shaft. Four S K F ball bearings, mounted in dustproof chambers, are used on this grinder. The grinding wheel guards are of the hinge-door type, with exhaust connections. Spark breakers and wired-glass eye shields are provided.

LESTER DIE-CASTING MACHINE

An improved type of the Lester die-casting machine, marketed by the P. & R. Tool Co., Inc., 100 Lamartine St., Worcester, Mass., and built by the Reed-Prentice Corporation of that city, is here illustrated. The chief difference between the improved machine and previous models lies in the provision of a mechanism that automatically fills the gooseneck which takes the molten metal from the furnace and delivers it to the dies under air pressure. The machine is designed for high-production service, being capable of producing from 250 to 300 pieces per hour with cores pulled from all sides of the die. Castings can be made in aluminum varying from a fraction of an ounce to 5 pounds, and of corresponding weights in other metals.

The machine is semi-automatic, the die-casting toggle mechanism being hydraulically operated.



Lester Die-casting Machine of Improved Construction

With a delivery of 3000 cubic inches of oil per minute, the machine will perform fifteen cycles per minute. The operating links are steel castings. One 10-horsepower motor will operate three of these machines at maximum production rates. The machine occupies a minimum amount of space because of the short cylinder stroke.

Operation of the machine is accomplished by means of two levers at the front, one of which is at the left in a horizontal position and the other in an adjacent vertical position. Movement of the horizontal lever brings the die-closing mechanism into action and, simultaneously, the gooseneck is forced into a mating aperture in the die. The vertical lever controls the air that forces the hot metal from the gooseneck into the die to form the casting. The gooseneck is disconnected from the high-pressure line when the die is open, thus eliminating danger of accidents. The reverse motion of the vertical lever closes the air line, and the reverse motion of the horizontal lever opens the die, at which time the cooled casting is automatically ejected.

"PEERLESS" GEAR-TOOTH CHAMFERING MACHINE

For chamfering the teeth of sliding gears used in transmissions, the City Machine & Tool Works, 1517-1531 E. Third St., Dayton, Ohio, has recently brought out the "Peerless" machine here illustrated. The machine shown in Fig. 1 is driven by an electric motor mounted within the column. Belt-driven machines can also be furnished. In motor-driven machines, power is transmitted directly from the motor to the cutter-spindle through a belt enclosed by the column.

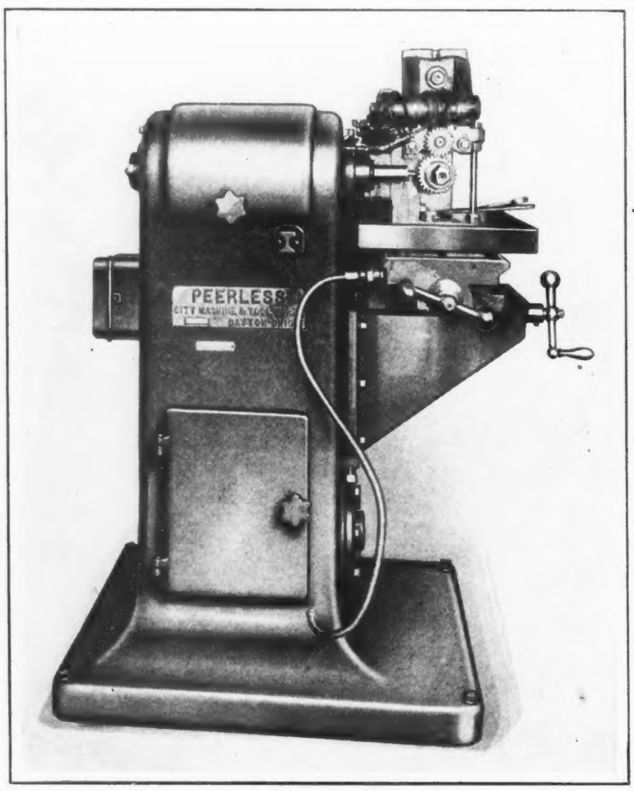


Fig. 1. Gear-tooth Chamfering Machine Built by the City Machine & Tool Works

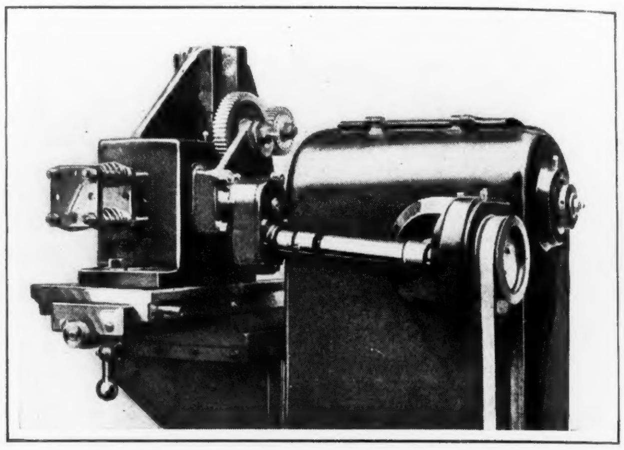


Fig. 2. Close-up View of Drive to Work Rotating and Oscillating Mechanisms

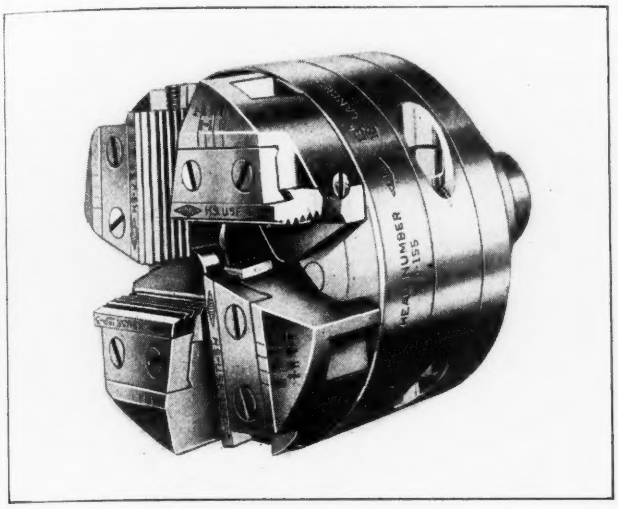
When the machine is in operation, the gear to be chamfered rotates continuously, and also oscillates at right angles to the axis of the cutter. As the work advances and recedes in proper timing with the speed of rotation, the cutter chamfers the ends of the teeth in passing over them and in and out of the tooth spaces. The cutter is a concave pointed end-mill.

The gear to be chamfered is mounted on the work-spindle of the machine, as shown in Fig. 1. Power for driving the work and the spindle-slide oscillating mechanism is taken from the main cutter-spindle through worm-gearing, bevel gears and a universal-joint drive shaft which is shown on the right-hand side of the machine in Fig. 2. This drive shaft transmits power through a pair of feed gears, so arranged that gears may be readily substituted to provide the desired rate of feed for chamfering gears of different sizes.

From the feed gears, power is transmitted to an idler gear, which meshes with the teeth of the gear to be chamfered, and also to a cam that provides the oscillating movement. This cam engages a roller on the horizontal slide in which the work-spindle is mounted, and moves the slide against the tension of four springs, which tend to force the slide toward the front of the machine, thus allowing the feeding of the work toward the chamfering cutter as the roller follows down the low side of the cam. Different cams are provided to give the proper form of chamfer to gear teeth of various pitches.

Centering of the gear with the cutter is accomplished by withdrawing a pin which locks one of the gears that drives the work-spindle. When this pin is withdrawn, the gears can be turned by hand the slight amount required to line up the work and the cutter properly, after which the pin is replaced. When a machine is to be used for gears of different pitches, additional sets of worms and idlers are furnished. This is necessary because the worm and idler that transmit power for rotating the work are of the same pitch as the teeth of the gear to be chamfered.

This gear-tooth chamfering machine has the necessary flexibility to provide for its application on all types of gears and to give the kind of chamfer required to meet service conditions. The machine runs continuously without any idle time.



"Landex" Die-head Designed for Automatic Screw Machine Use

"LANDEX" ROTARY PULL-OFF DIE-HEAD

The "Landex" die-head, recently placed on the market by the Landis Machine Co., Inc., Waynesboro, Pa., for application to automatic screw machines, is opened by retarding the forward movement of the die-head or die-holder and is closed automatically by an attachment on the screw machine. The head is flexible on the shank to compensate for any misalignment in the machine or in the work to be threaded. The chasers are supported on the front face of the head from which they can be easily removed for grinding or when changing from one pitch to another.

A worm employed for adjusting the head to size is kept under the proper turning tension at all times, thereby eliminating the necessity for locking it after each adjustment. A micrometer dial is provided for further adjustments to suit close or free fits. The die-head is locked within itself under service conditions by the engagement of two hardened closing pins and bushings. The spring for opening the head is located in the adjusting ring and has a uniform tension for all diameters.

The head is made in 1/2-, 13/16-, and 1 1/8-inch sizes, and each head is graduated for bolt and pipe threads within its respective range. Each graduation is separate, one from the other, and has its own index mark on the operating ring. All passages and openings into the interior of the head are covered under service conditions to prevent dirt and chips from entering.

"PULLEYSTONE"—PULLEY-SURFACING MATERIAL

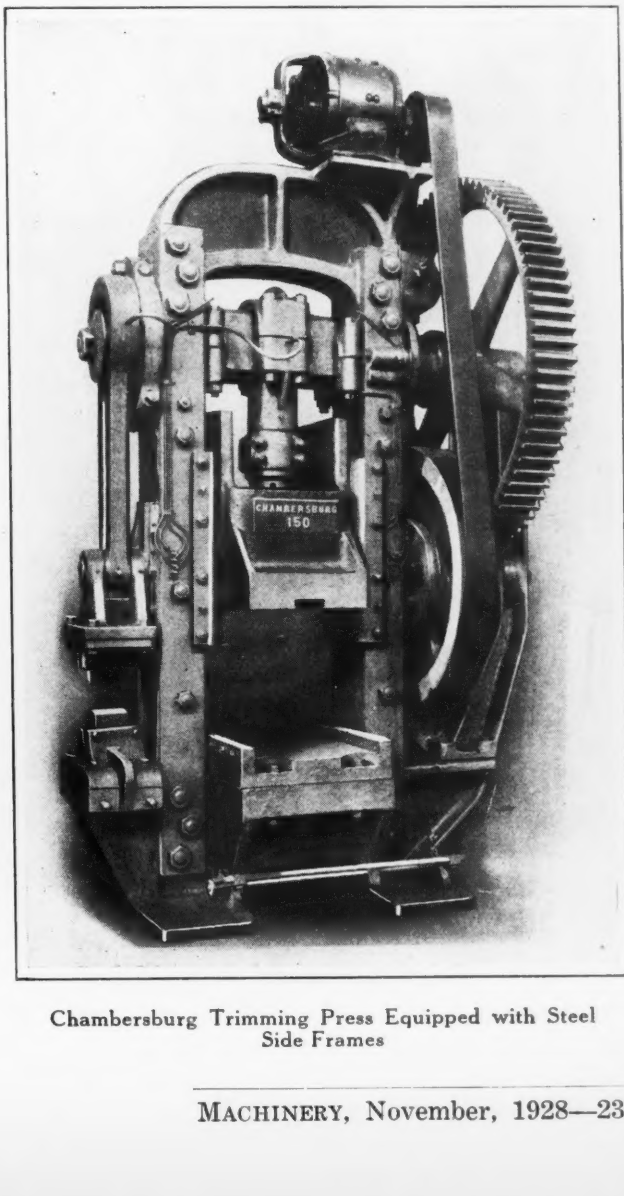
A plastic material intended for application to the belt surface of iron, steel, or wood pulleys in order to increase the power transmitting efficiency has recently been placed on the market by the Chicago Belting Co., 113-125 N. Green St., Chicago, Ill. It is claimed that the power output of a pulley driven by leather, rubber, or canvas belting will be greatly increased by applying a coating of "Pulleystone," and that this is accomplished without abrasion of the belt. "Pulleystone," which comes in twenty-pound cans, can be readily applied to pulley surfaces by hand.

CHAMBERSBURG TRIMMING PRESS WITH STEEL SIDE FRAMES

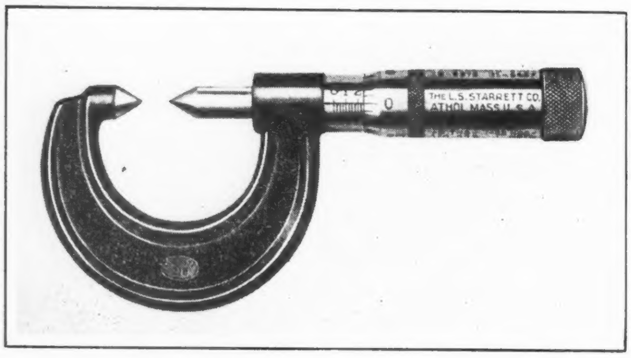
Forged-steel side frames have been adopted for the new trimming press recently brought out by the Chambersburg Engineering Co., Chambersburg, Pa., with a view to eliminating side frame breakage as a hazard of press operation. These side frames are strong I-section forgings, and are used in conjunction with a heavy semi-steel bed frame and yoke. Other features of the construction consist of the use of outboard bearings on all shafts and a patented friction slip flywheel.

The flywheel is so designed as to prevent it from bursting and breaking the crank or gears when an overload stalls the press. The energy developed by the sudden stopping of the machine, instead of expending itself by straining all moving parts, is released by the flywheel slipping on its hub against friction. Adjustments of the press are rarely necessary after slipping of the flywheel.

Other new features of the press include the provision of roller bearings on auxiliary shafts; directly renewable clutch jaws and cam; a pitman adjustment that grips threads the entire length of the screw; high-pressure grease lubrication of all bearings and contacting surfaces; improved method of clutch operation; easier operation of the treadle; reduced floor space requirements; and free accessibility of the machine from the rear. This press is supplied in either single- or double-crank construction.



Chambersburg Trimming Press Equipped with Steel Side Frames



Starrett Screw-thread Comparator

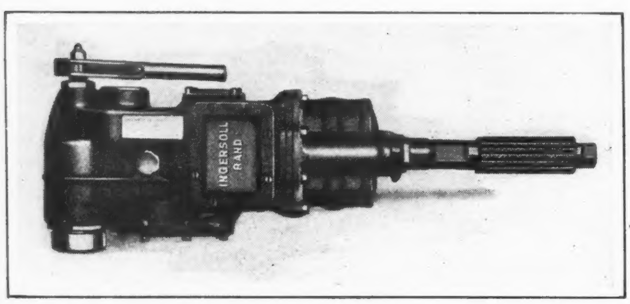
STARRETT SCREW-THREAD COMPARATOR

A No. 210 screw-thread comparator recently announced by the L. S. Starrett Co., Athol, Mass., is primarily intended for taking measurements when cutting screw threads, but it can also be used for a variety of other purposes. For example, it can be used in measuring small grooves or recesses where the ordinary micrometer cannot readily be employed.

The instrument does not measure the actual diameter of a V-thread, being intended rather for making comparisons. Its anvil and spindle contacts are conical, and are flattened about 1/64 inch. This comparator comes in two standard sizes, for measuring from 0 to 1 inch and from 1 to 2 inches, respectively. It is also made with metric graduations. Larger sizes are furnished upon request.

INGERSOLL-RAND CLOSE-QUARTER DRILL

A size 90 gear-driven drill with a two-cylinder double-acting air motor has been developed by the Ingersoll-Rand Co., 11 Broadway, New York City.



Ingersoll-Rand Air-operated Close-quarter Drill

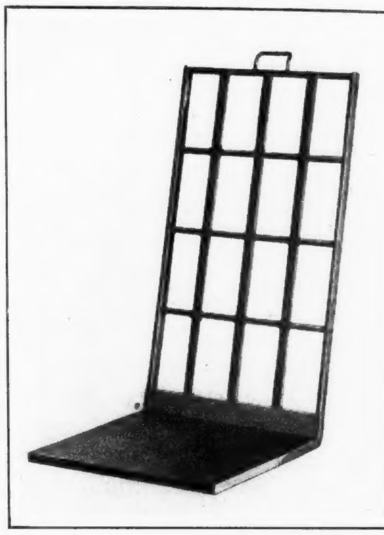
This drill has been brought out for general drilling, reaming, and tapping in close quarters. It develops approximately 20 per cent more horsepower and has a 10 per cent higher stalling point than previous types.

With a view to obtaining smooth operation, the pistons are arranged at right angles to and in a plane with the spindle, a counterbalanced crank is used, and special gears are employed. Anti-friction bearings of the ball or roller type are used throughout. Three different spindles can be furnished as follows: The standard spindle which has a No. 4 Morse taper socket; a threaded spindle 1 11/16 inches in diameter, having twelve threads per inch, to take square-socket chucks or the Rich chuck; and a "Use-Em-Up" spindle, which has a No. 4 "Use-Em-Up" taper socket.

The average working speed with an air pressure of 90 pounds per square inch, is 140 revolutions per minute. The weight is 41 pounds, and the length over all, 9 1/4 inches. The device has a capacity for reaming and tapping holes up to 2 inches and for drilling holes up to 3 inches.

WORK RACK FOR HAND TRUCKS

A rack for holding parts, boxes, etc., in such a manner that they can be readily picked up and transported from one point to another by means of a truck has recently been placed on the market by the American Pulley Co., 4200 WissahickonAve., Philadelphia, Pa. This rack, known as the "Truk-Pak" is built of pressed steel. The deck is a steel plate, welded to two steel forgings which are bent upward and welded to the inside of the channels that form the back or upright member. All joints and intersecting members are electrically welded.

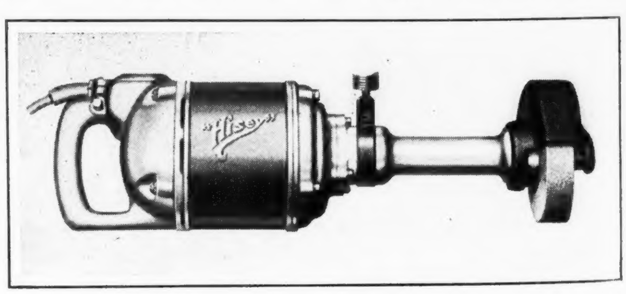


"Truk-Pak" for Holding Work or Boxes Transported by Hand Trucks

The deck is raised a sufficient amount above the floor to permit a truck nose to enter without lifting or disturbing the load. The dimensions are 28 inches wide by 48 inches high, making the "Truk-Pak" suitable for use with almost every style and size of hand truck. The "Truk-Paks" stand upright when loaded or empty, and take up little space when not in use, as they can be nested in stacks.

HISEY-WOLF GRINDER AND BUFFER

A 1/2-horsepower portable grinder and buffer equipped with a ball-bearing motor and a Timken tapered roller-bearing grinding spindle has recently been added to the line of the Hisey-Wolf Machine Co., Cincinnati, Ohio. This new grinder is made in both alternating-current and direct-current types. The alternating-current type has a speed of 3425 revolutions per minute, under no load, and the direct-current type has a no-load speed of 3550 revolutions per minute. Both types use 6 1/2- by

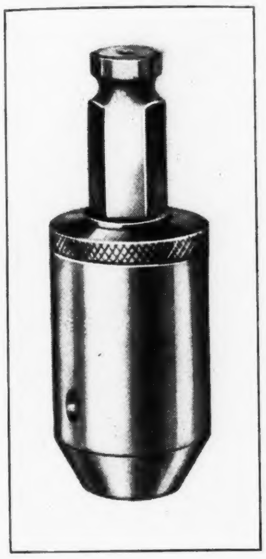


Hisey-Wolf 1/2-horsepower Grinder and Buffer

1 1/4-inch grinding wheels with a 3/4-inch hole. The net weight, with the guard in place, is 42 pounds.

MONARCH STUD DRIVER

A hexagonal-shank stud driver has recently been added to the line of hand and machine type stud drivers made by the Monarch Tool & Mfg. Co., 2704 E. Larned St., Detroit, Mich. This new tool is designed for use in air- or electrically-driven machines operated at comparatively high speeds to permit the rapid insertion of threaded studs in parts.



Monarch Stud Driver with Hexagonal Shank

As in the case of the hand and other machine type stud drivers made by this company, the construction is such that the studs can be driven in place at any pressure desired without injury to the threads. By simply reversing the direction of rotation, the stud driver can be easily and quickly backed off. The stud drivers are made in four sizes; the smallest, or No. 1 size will handle any stud up to 3/8 inch in diameter, and the largest, or No. 4 size, any stud from 1 to 1 1/4 inches in diameter.

GITS HAND-COMPRESSOR AND FITTINGS FOR HIGH-PRESSURE LUBRICATION

A high-pressure hand-compressor and pressure fittings for industrial and automotive lubrication have recently been placed on the market by the Gits Bros. Mfg. Co., Hawthorne Station, Chicago, Ill. The connection between the compressor or "gun" shown in Fig. 1 and the fittings, one type of which is shown in Fig. 2, is such that there is no "back shot" of grease when the compressor is released. Another advantage of this fitting is the low head, which projects only 3/8 inch beyond the threaded portion. The fittings and compressor are so constructed that lubricant as heavy as No. 5 cup grease or liquid as light as kerosene can be used successfully. Pressure in excess of 3000 pounds can be obtained with the hand-compressor, and by employing a compound compressor of the leverage type, pressure up to 10,000 pounds can be obtained.

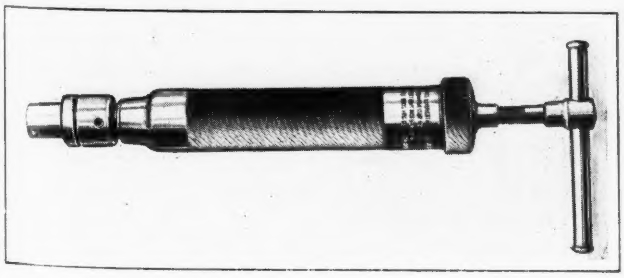


Fig. 1. Gits Hand-compressor for High-pressure Lubrication

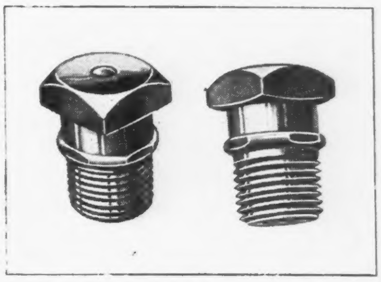
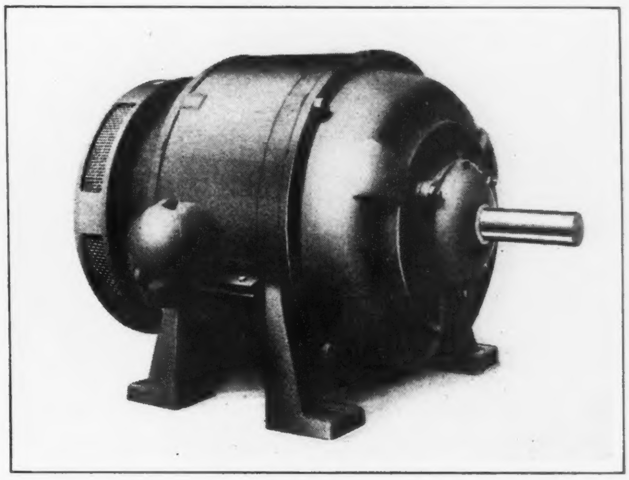


Fig. 2. Fitting for High-pressure Lubrication

Five angular type fittings are made, in addition to the straight type shown in Fig. 2. These permit the gun to be applied at various angles from 25 to 90 degrees. The machined nozzle of the compressor is casehardened, and the square opening fits easily but snugly over the fittings, which are also casehardened. A slight turn of the gun to the right causes the valve in the nozzle to seat properly on the fitting and thus provide a leak-proof connection. While seating, the nozzle valve automatically opens, and lubricant can then be forced through the fitting into the bearing by turning the sliding cross-handle. The gun is automatically disengaged from the fitting by a slight turn to the left.

RELIANCE FAN-COOLED INDUCTION MOTORS

The type AA fully enclosed fan-cooled induction motors described in December, 1927, MACHINERY, page 320, are now built in various sizes ranging from 1 1/2 to 40 horsepower, by the Reliance Electric & Engineering Co., 1042-1090 Ivanhoe Road, Cleveland, Ohio. These motors are designed for use in places where they are exposed to considerable dirt, iron dust, or moisture. They are also constructed to lessen or eliminate the fire hazard in chemical plants, woodworking shops, etc.



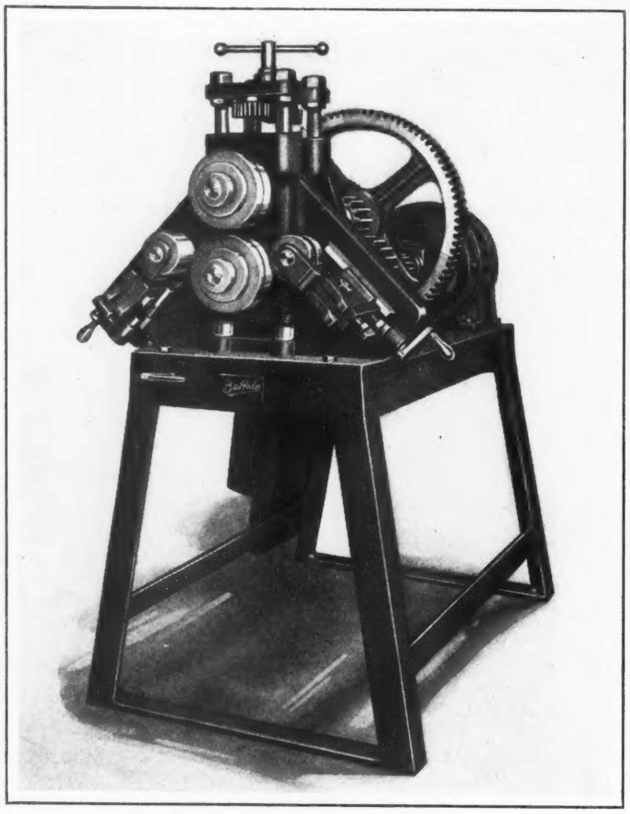
Skeleton-frame Fully Enclosed Fan-cooled Motor Built by Reliance Electric & Engineering Co.

The new skeleton-frame type AA fully enclosed fan-cooled induction motor shown in the accompanying illustration has a single exhaust-type fan mounted on an extension of the shaft, outside the front bearing bracket. The cooling air is drawn through openings at the center of the back bearing bracket, and after passing over the radiating bonnets and stator, is exhausted at the front end of the motor.

BUFFALO VERTICAL-TYPE BENDING ROLLS

A No. 0 bending roll has recently been added to the line of bending machines built by the Buffalo Forge Co., 144 Mortimer St., Buffalo, N. Y. Although the smallest of the line, this bending roll has the same operating characteristics as the larger machines. There is an all-steel one-piece frame supported by legs, and a table of welded steel. A triple set of hand-operated cranks facilitates changing the rolls, and this can be done in a few seconds. The working parts are lubricated by the Zerk system. On a motor-driven machine, the two-horsepower motor is equipped with a switch box and push-button control. The machine can also be arranged for belt drive.

This No. 0 bending roll has a capacity for bending, with the leg outward, angle-irons as large as 1 1/4 inches by 3/16 inch to a minimum diameter of 7 inches, and as small as 1/2 inch by 1/8 inch to a minimum diameter of 6 inches. Flat bars up to 1 1/2 inches by 3/8 inch can be bent on edge to a minimum diameter of 7 inches, while flat bars from 2 inches by 3/8 inch to 2 1/2 inches by 1/2 inch can be bent on the flat to a minimum diameter of 6 inches. Round bars 7/8 inch in diameter and



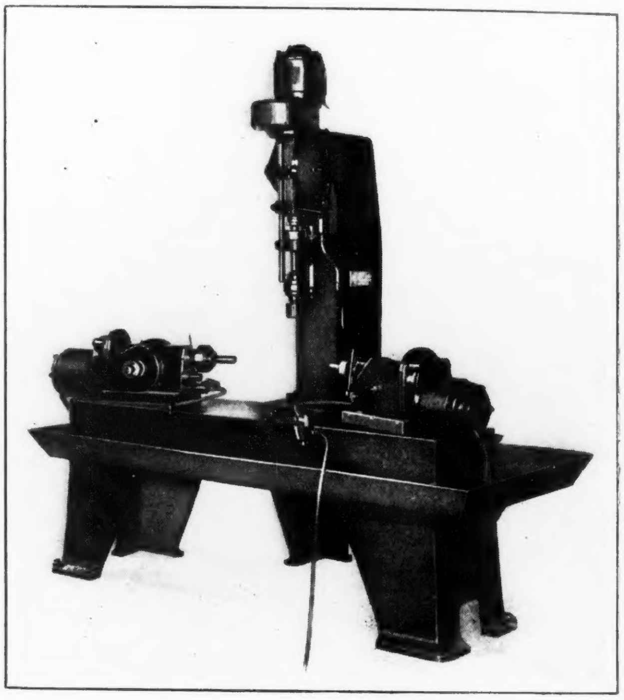
Buffalo Motor-driven Bending Rolls

11/16-inch square bars can be bent to a minimum diameter of 6 inches. This equipment weighs approximately 750 pounds.

MILLHOLLAND TAPPING AND REAMING MACHINE

A combined tapping and reaming machine recently built by the Millholland Sales & Engineering Co., 1833 Ludlow Ave., Indianapolis, Ind., embodies three automatic drill units made by this concern. There are two horizontal heads mounted in saddles located in angular positions on the machine bed, while the third unit is arranged vertically. The vertical unit is used for tapping. All three units are controlled by means of a single air-operated valve. The feed-cams are made to give a rapid approach, proper tool feeds, and a fast return to the heads. The machine is designed with a view to making it adaptable to suit possible changes in the part machined.

Four machines were built for one manufacturer for the operations mentioned, and two more for



Millholland Tapping and Reaming Machine with Automatic Control

drilling and counterboring. The feed-cams on the latter machines are made with two rates of tool feed, so as to provide efficient feeds for counterboring and drilling when using combination tools.

Any unit can be "cut out" of operation at any position of the spindle and returned to the starting position without disturbing the other units. This is accomplished by means of a trip-lever at the front of each head. An automatic safety device releases the feed of the spindles when the tools do not advance because of dull cutting edges or hard spots in the work. This device also sounds an audible signal to warn the operator of the fact.

* * *

THE LATEST MOTOR LINER

The largest and latest ocean liner provided with oil engines is the *Augustus* of the Italian Navigation Line, which has just crossed the ocean from Genoa to New York on its maiden voyage. This ship has a tonnage of 32,500, and is equipped with oil engines developing 42,600 indicated horsepower. The length of the ship is approximately 720 feet, and its width, 83 feet. Not only is this ship of unusual interest on account of its large oil engines, but it is also one of the most luxurious vessels ever built for ocean service. Among the unusual innovations for the pleasure and comfort of the passengers is an open-air swimming tank located on the top deck of the ship, this entire deck being really a bathing beach.

Questions and Answers

SAFETY DEVICES

M. N.—A boilermaker, while using an air hammer, suffered injury through the accidental tripping of the trigger, which forced the die out of the barrel, striking the workman. Is the employer liable on the ground of his failure to provide a safety device that would have prevented this unexpected projection of the die?

Answered by Leslie Childs, Attorney at Law, Indianapolis, Ind.

This case will raise a question of fact as to whether the failure of the employer to provide a safety device constituted negligence on his part. In affirming a judgment against an employer for injury growing out of an accident similar to that described in the question, the Court said: "The . . . testimony shows that if the gun in question had been supplied with the . . . guard . . . the injury would not have occurred; that said guard could have been furnished at a moderate cost, and used without impairing the effectiveness of the gun. Taking into consideration the facts in this case, we are of the opinion that the trial court committed no error in submitting to the jury the question as to whether defendant was in the exercise of ordinary care in directing plaintiff to use the gun in question, without its being supplied with the . . . guard, or some other device to render it reasonably safe without such guard." (253 S. W. 749).

COMPOSITION OF "Y-ALLOY" METAL

L. R. S.—What is the exact composition of the metal known as "Y-alloy," which I understand is used for pistons and cylinder heads of air-cooled airplane engines? What are its chief physical characteristics and machining properties?

Answered by R. L. Templin, Chief Engineer of Tests, Research Bureau, Aluminum Co. of America, New Kensington, Pa.

The alloy made and sold by the Aluminum Co. of America under the commercial number or trade designation 142, corresponds and is quite similar to "Y-alloy." This alloy has good machining characteristics, as compared with most other aluminum alloys, but as is the case with all such alloys, the shape of the tools must be somewhat different from that of tools used for steel if the best results are to be obtained.

The chemical composition and physical characteristics of this metal were given in a paper by the writer, C. Braglio, and K. Marsh, presented before the spring meeting of the American Society of Mechanical Engineers in Pittsburgh, Pa., May, 1928. The chemical composition of the "Y-alloy" No. 142, as given in this paper, is: Silicon, 0.25 per cent; iron, 0.47 per cent; copper, 3.96 per cent; manganese, 0.02 per cent; magnesium, 1.33 per cent; nickel, 2.30 per cent; and the remainder 91.67 per cent aluminum.

The tensile strength of this metal, as cast, ranges from 27,650 pounds per square inch at a temperature of 75 degrees F., down to 3600 pounds per square inch at a temperature of 800 degrees F. The yield point ranges from 23,250 pounds per square inch at 75 degrees F. down to 1750 pounds per square inch at a temperature of 800 degrees F. The elongation in 2 inches ranges from 0.50 at 75 degrees F. up to 58.5 per cent at 800 degrees F. The reduction in area ranges from 0.000 at 75 degrees F. to 46.9 per cent at 800 degrees F. The modulus of elasticity, in pounds per square inch, ranges from 10,000,000 at 75 degrees F. to 1,800,000 at 800 degrees F.

The heat-treated "Y-alloy" has a tensile strength ranging from 37,150 pounds per square inch at a temperature of 75 degrees F., down to 3200 pounds per square inch at a temperature of 800 degrees F. The yield point ranges from 29,000 pounds per square inch at 75 degrees F., to 1500 pounds per square inch at 800 degrees F. The elongation in 2 inches is 1 per cent at 75 degrees F. and 44 per cent at 800 degrees F. The reduction in area ranges from 0 at 75 degrees F. to 39.2 per cent at 800 degrees F. The modulus of elasticity ranges from 10,000,000 pounds per square inch at 75 degrees F. to 830,000 pounds per square inch at 800 degrees F.

Answered by A. Eyles, Moston, Manchester, England

During the last few years efforts to improve the mechanical properties of aluminum and at the same time retain the desirable properties of this metal in its pure state have resulted in the development of a large number of light weight aluminum alloys intended for use in the automobile and airplane industries. The Y-alloy metal is one of the best so far produced. This alloy was developed by the British National Physical Laboratory in its efforts to produce a piston alloy giving the maximum strength at working temperatures consistent with high thermal conductivity and a low coefficient of friction.

The history of the development of the Y-alloy is given in detail in the eleventh report of the Alloys Research Committee of the British National Physical Laboratory. Among the main points of interest of this metal are susceptibility to heat-treatment and excellent tensile and fatigue properties, when properly cast and heat-treated.

The Y-alloy metal can also be readily forged and rolled, and as a die-casting alloy, gives little trouble when its properties are once understood. The castings produced are peculiarly white, clean, and close-grained, giving a beautiful machined surface. Although Y-alloy is the term by which this alloy is most generally known, it is at times referred to as "Magnalite," L24 (British Engineering Standards Association Specification) and as "4-2-1 1/2" alloy. It contains copper, nickel, and magnesium in the approximate respective proportions of 4, 2,

to the "STANDARD" *line*—

the Brown & Sharpe No. 2 "Standard" Vertical Spindle Milling Machine

FEATURES

Controls

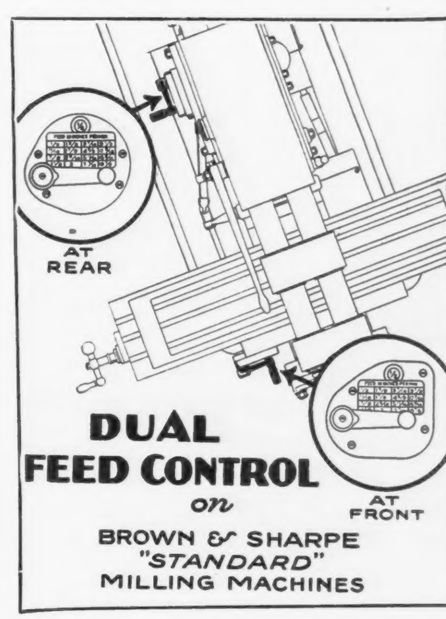
Single Lever for Speed Changes (in two series) . . . Single Lever for Feed Changes at each of the operating positions—front and rear of table . . . Direct Reading Dials indicate rate of feed and speed engaged . . . Power Fast Travel, in all directions. Gear driven through safety clutch . . . Directional Feed Engagement Levers for all feeds, at front and rear of table . . . Knee clamped from front or rear of table . . . Automatic Feed for Spindle—easily controlled from either operating position—automatically released at any point . . . Micrometer Stop on spindle for controlling depth of cut.

Construction

Sliding Gear Feed and Speed Transmissions . . . Dry Multiple Disk Clutch, self-compensating for wear . . . All Gear Drive; heat-treated alloy steel gears . . . Anti-friction bearings for Spindle,—Speed, Feed, and Power Fast Travel Transmissions,—also for Main Drive Pulley . . . One-piece Knee Screw completely guarded at all positions . . . Spindle head counter-balanced.

Lubrication

Column and Main Drive mechanisms automatically lubricated with filter oil system . . . Knee mechanism automatically lubricated by separate pump . . . Saddle mechanism and table bearings lubricated from single station.



BROWN & SHARPE

BROWN & SHARPE MFG. CO. — PROVIDENCE, R. I., U. S. A.

and 1 1/2 per cent. The chemical composition lies within the following range:

Copper	3.5 to 4.5
Nickel	1.8 to 2.3
Magnesium	1.2 to 1.7
Silicon	0.0 to 0.75
Iron	0.0 to 0.75
Aluminum	Remainder

When cast in a chill mold, the tensile strength of this alloy is approximately 28,000 pounds per square inch, with 1 per cent elongation in 2 inches, but on heating for six hours at 977 degrees F. in a nitrate bath, followed by quenching in boiling water and ageing for five days at normal air temperatures, the strength may rise to 47,000 pounds per square inch with an elongation of 6 per cent in 2 inches.

For sand-cast specimens, the corresponding tensile strength is 25,500 pounds per square inch, as cast, and 38,000 pounds per square inch after heat-treatment. This metal is remarkably good, both as regards heat conductivity and strength at high temperatures, and has very satisfactory machining qualities. The tensile strength of Y-alloy metal at various temperatures is as follows: 30,000 pounds per square inch at a temperature of 68 degrees F.; 27,000 pounds per square inch at a temperature of 482 degrees F.; and 10,500 pounds per square inch at a temperature of 662 degrees F.

The machining and working properties of Y-alloy metal are similar to those of duralumin. It can also be softened in the same way and at approximately the same temperatures. In the process of hot forging, the temperature is perhaps the most important factor. It is essential to employ an accurate means of temperature measurement and control. Forging at too high a temperature will cause the alloy to crumble, while forging at too low a temperature so hardens the alloy that it cracks. Experience shows that the most suitable temperature range for forging this alloy is between 878 degrees F. and 914 degrees F.

The Y-alloy metal is easily machined, but it is generally advisable to use some form of lubricant. Unlike aluminum in the pure state, it does not seize or drag on the tool when hardened. A suitable lubricant prevents the chips from becoming embedded in the teeth of a milling cutter or from adhering to the edges of other cutting tools. A satisfactory mixture for general use contains equal parts of kerosene and lard oil, while for heavy cuts and slow feeds, such as are used in tapping or roughing work, pure lard oil gives good results.

In milling, drilling, and sawing, a soluble cutting oil will be found satisfactory and more economical than kerosene and lard oil lubrication. Kerosene used alone is also quite satisfactory when turning, drilling, and tapping. On no account should alkaline lubricants such as "suds" be used. Grinding is the customary method of finishing Y-alloy pistons, and a fine finish can be obtained in this manner.

Single-cut files should invariably be used, as double-cut files are more likely to become clogged. Clogged files can, however, be readily cleaned by immersion for a few seconds in a strong caustic soda solution, after which the metal particles are easily wiped off. After this treatment, the files should be washed in running water and carefully dried in sawdust or they are likely to rust. Sand-blasting is another good method of cleaning files clogged with aluminum alloy metal. Tools for machining Y-alloy metal should have keen smooth edges and appreciably more than the customary amount of top and side clearance.

CONFIRMATION OF ORDERS

D. G. P.—We are involved in serious litigation as the result of an employe sending an order for an expensive machine directly to the manufacturer without having the order confirmed. It is our usual practice to have all orders confirmed. The manufacturer is suing us on the grounds that he did not know that our rule is to have all orders confirmed. He claims that he acted in good faith in filling the order and making the shipment to us. Do you think the manufacturer can force us to accept and pay for the machine?

Answered by Leo T. Parker, Attorney at Law, Cincinnati, Ohio

If you performed no act that leads the manufacturer to believe that your employe was authorized to sign valid contracts of sale, you are not liable on this contract. A leading case of this subject is 90 Atl. 108. Here it was disclosed that an employer employed a "buyer." The buyer was authorized to fill in orders for merchandise and submit them to the proprietor of the business for his confirmation. This buyer was supplied with blank orders, but he was not authorized to make valid contracts for purchase of goods. His authority was strictly limited to selecting the goods and making out the orders and submitting them to the proprietor for his approval and signature.

A traveling representative that had never sold goods to the firm interviewed its buyer, and the latter gave this salesman a signed order for $1090 worth of merchandise without the knowledge of the proprietor of the business. The seller shipped the goods without delay. Upon receiving notice of the shipment, the proprietor refused to accept the goods and wrote the seller explaining that the buyer had no authority to give a valid order. The seller filed suit, contending that he believed the buyer had authority because he was supplied with blank order forms. However, the Court held the proprietor not liable and explained the law on this subject in the following language:

"A general authority empowers the agent to bind the employer by all the acts within the scope of his employment, and that power cannot be limited by any private order or direction *not known to the party dealing with the agent* . . . In the case at bar, the buyer was not authorized to purchase goods for the store." . . .

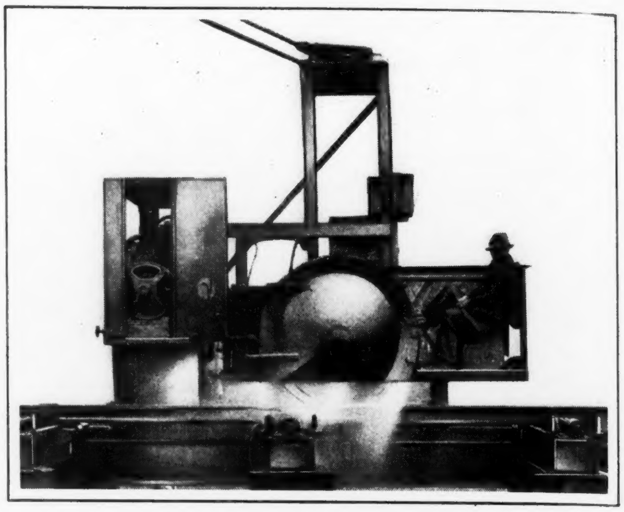
On the other hand, if an employer does any act which leads a seller to believe that a buyer has authority to make binding contracts, the employer is liable. In other words, the outcome of a litigation of this kind hinges upon whether or not the seller believed the buyer or employe was authorized to enter into valid contracts, and whether the seller had good reason to believe he had this authority.

FRICTION SAW SALVAGES WORN-OUT RAILS

Rails worn out in service on the electric transportation systems of the Interborough Rapid Transit Co., New York City, are made into guard rails by stripping off a portion of the base. This strip is cut off the entire length of standard rails with a friction saw, as shown in the illustration. Engineers of Joseph T. Ryerson & Son, Inc., 16th and Rockwell Sts., Chicago, Ill., developed this application of the saw.

The cutting is done with a steel blade, 56 inches in diameter and 1/4 inch thick, which is revolved at a peripheral speed of nearly 5 miles per minute. The blade cuts through the rail section at a speed varying from 4 1/2 to 6 1/2 feet per minute, and produces a clean cut the entire length of the rail. The machine has an arc-welded structural frame and runway upon which the carriage travels. The carriage is also arc-welded and carries a 100-horsepower friction-saw motor and the blade, as well as a three-horsepower motor and a reduction unit for traversing the carriage on the runway.

A 70-gallon pump driven by a 7 1/2-horsepower motor supplies water at a pressure of 150 pounds per square inch for cooling the blade. As the machine moves back and forth on the runway, the pump draws up the water from a trough beside the frame to which it is returned after it has been delivered to the saw blade. The operating power, which is direct current, varying from 550 to 650 volts, is taken from two overhead trolley poles. Five air clamps hold the rails being cut. The operator rides along on the carriage and can thus watch the work closely, all controls being located within easy reach.



Friction Saw Run at a Peripheral Speed of Five Miles a Minute to Cut 100-pound Rails

PERSONALS

D. Walker Wear has been elected president of the Stow Mfg. Co., Inc., Binghamton, N. Y.

Harold L. Crull has been appointed assistant sales manager of the Oilgear Co., Milwaukee, Wis.

Fred H. Doolittle has been appointed field representative of the Gray Iron Institute in the central states.

H. D. Epting has been transferred from the Philadelphia sales office of the Wagner Electric Corporation, 6400 Plymouth Ave., St. Louis, Mo., to the Atlanta sales office.

R. W. Piper has joined the transformer sales division of the Wagner Electric Corporation, 6400 Plymouth Ave., St. Louis, Mo. He will travel through the southeastern district.

George F. Joyce has been appointed assistant sales manager of the Magnetic Mfg. Co., Milwaukee, Wis., for Chicago and vicinity. The office has been moved to larger quarters at 720 Cass St.

Walter G. Hildorf has been placed in charge of all metallurgical work for the Timken Steel & Tube Co., Canton, Ohio. For the last few years Mr. Hildorf has been metallurgical engineer for the Reo Motor Car Co., Lansing, Mich.

N. L. Mortensen

N. L. Mortensen has been appointed chief engineer for the Cutler-Hammer Mfg. Co., Milwaukee, Wis. T. E. Barnum, formerly chief engineer, has been appointed consulting engineer, and will devote his entire attention to engineering problems, and outside engineering relations. Mr. Mortensen has been connected with the Cutler-Hammer Mfg. Co. for twenty-one years, the last five of which he has been assistant to Mr. Barnum.

F. R. Fishback, president of the Electric Controller & Mfg. Co., Cleveland, Ohio, has been elected vice-president in charge of the Apparatus Division of the National Electrical Manufacturers' Association.

George L. Bitting, director of sales of the Bunting Brass & Bronze Co., Toledo, Ohio, has resigned. He has made no immediate plans for the future, and will remain at his home in Toledo for a time before resuming activities in the industrial and mechanical fields.

B. W. Rogers, 225 Central Savings and Trust Building, Akron, Ohio, has been appointed representative of the Falk Corporation for Akron and vicinity. Mr. Rogers was previously connected with the B. F. Goodrich Co., and before that with the Allis-Chalmers Mfg. Co.

George A. Cooper, superintendent of materials of the Monongahela West Penn Public Service Co., Fairmont, W. Va., has been appointed assistant chief business specialist in the Division of Simplified Practice of the Bureau of Standards, United States Department of Commerce.

E. J. Phillips, who has been selling the products of the Van Dorn Electric Tool Co. in Detroit, Mich., has been transferred to the San Francisco territory. His position in Michigan will be filled by his brother, George Phillips. J. F. Spaulding has been transferred to the Baltimore territory to fill the vacancy caused by the transfer of Jack Beggs from Baltimore to the company's headquarters in Cleveland.

Kenneth B. Spaulding, formerly sales manager of the McCrosky Tool Corporation, Meadville, Pa., has been made sales manager of the Wesson Sales Co., 7338 Woodward Ave., Detroit, Mich. The Wesson Sales Co. handles "Eclipse" interchangeable counterbores, John Bath ground thread taps and "Widia" cutting metal. This company has recently been appointed exclusive distributor of "Widia" cutting metal in the Detroit and Chicago districts.

OBITUARY

F. S. Blackall, Sr., vice-president and general manager of the Taft-Peirce Mfg. Co., Woonsocket, R. I., died at his summer home in Woodmont, Conn., October 6. Mr. Blackall was born in Brooklyn sixty-three years ago, and most of his life was spent as a consulting engineer and as a manufacturer of automatic machines, precision tools, and printing machinery. From 1888 to 1903, he was president of Blackall & Baldwin, builders of machinery. The companies with which he was associated at his death were many and varied. Apart from his official connection with the Taft-Peirce Mfg. Co., he was president of the Interchangeable Parts Co., vice-president and general manager of the Mott Haven Co., and a director of Parks & Parks, Inc.

TRADE NOTES

IDEAL COMMUTATOR DRESSER CO., 1011 Park Ave., Sycamore, Ill., is now represented in the New England territory by Albert E. Mace Co., Inc., 93-97 Heath St., Boston, Mass.

WHITING CORPORATION, Harvey, Ill., has appointed the D. S. Mair Machinery Co., Houston, Tex., as Texas agent for the company, handling the complete Whiting and Swenson lines.

GEORGE BATTEN CO., INC., and BARTON, DURSTINE & OSBORN, INC., advertising agents, have combined to form a new organization known as BATTEN, BARTON, DURSTINE & OSBORN, INC.

ARTHUR JACKSON MACHINE TOOL CO., Toronto, Canada, has moved into its new offices, showroom, and warehouse at 9 Front St. East, Toronto. This move was necessitated by the rapidly expanding business of the company.

ERIE FOUNDRY CO., Erie, Pa., manufacturer of steam hammers and rubber-working machinery, has placed a contract for the erection of a brick and steel addition to its present machine shop on W. Twelfth St. The new building will be 62 by 100 feet.

OHIO STATE FOUNDRYMEN'S ASSOCIATION, 5713 Euclid Ave., Cleveland, Ohio, announces that the organization has been incorporated under the name of the OHIO FOUNDRIES ASSOCIATION, INC. C. C. Smith of the Toledo Steel Casting Co., Toledo, Ohio, is president.

LINDE AIR PRODUCTS CO., 30 E. 42nd St., New York City, has opened a new oxygen producing plant at 125 Settlement St., Akron, Ohio, which will meet the local demand for oxygen used in welding and cutting by the oxy-acetylene process. The new plant will be operated under the direction of A. Deagon.

FOOTE BROS. GEAR & MACHINE CO., 232 N. Curtis St., Chicago, Ill., has recently appointed A. H. Tischer, 704 N. Alabama St., Indianapolis, Ind., representative of the company in the Indiana territory south of the line drawn below the city of Fort Wayne, Ind., and including the city of Louisville, Ky.

JOSEPH T. RYERSON & SON, INC., 16th and Rockwell Sts., Chicago, Ill., have acquired the plant, merchandise, and good will of the E. P. Sanderson Co. at Third, Binney and Munroe Sts., Kendall Square, Cambridge, Mass. This acquisition will greatly increase the company's facilities for the immediate shipment of iron and steel.

P. H. & F. M. ROOTS CO., Connersville, Ind., announces that anti-friction bearings have been adopted for use in the blowers made by this company. Either Timken or S K F heavy-duty roller bearings are employed in the standard line of blowers, and the Acme line of smaller units carries roller or ball bearings upon specification.

DOEHLER DIE CASTING CO., 386 Fourth Ave., New York City, has purchased from the Metal Mold Castings Co. of Buffalo, N. Y., that company's permanent mold casting equipment, dies, molds, and other tools, and will add these facilities to the present Doehler permanent mold department. The Metal Mold Castings Co. has ceased business.

JACKSON SALES CO., 533-535 S. Park Ave., Jackson, Mich., is the new name of the company formerly known as the AUTO PRODUCTS CORPORATION. Coincident with the change of name of the company, the line of screw machine products formerly manufactured has been discontinued, and the business is now confined to sales of new and used metal-working machinery.

GEARS & FORGINGS, INC., Cleveland, Ohio, has erected a modern administration building which will serve as headquarters for the executive offices, sales, engineering, and planning departments. The first floor is given over to advertising, cost accounting, billing, etc. The general management or sales executives are located on the second floor, while the third floor is devoted to the purchasing and engineering departments.

BLOOM & KAMRATH, Monadnock Block, 330 S. Dearborn St., Chicago, Ill., is a new firm that has been formed for the purpose of designing plants and systems for the cooling of buildings of all descriptions, humidity control systems, both for industrial purposes and for ventilation, as well as systems for industrial applications of ozone. High- and low-temperature drying systems are also among the specialties that the new firm is prepared to design.

OILGEAR CO., 667 Park St., Milwaukee, Wis., manufacturer of hydraulic equipment and hydraulic broaching machines, is erecting an addition to its plant that will practically double the present floor space of the factory and will give the company a total floor area of approximately 60,000 square feet. Equipment to the value of $60,000 has been purchased to be placed in the new addition of the plant, which has been required by the rapid expansion of the company's business.

CINCINNATI BALL CRANK CO., Cincinnati, Ohio, has recently made extensive changes in the executive organization. LUDWIG KEMPER succeeds CLIFFORD GREENE as president, Mr. Greene retiring from active management, but continuing in the capacity of chairman of the board of directors. ROBERT WALLACE succeeds A. B. BREEZE as general manager, and W. G. LANGDON succeeds C. H. VAN PELT as sales manager. Messrs. Kemper, Wallace, and Langdon formerly held positions at the Detroit plant of the Midland Steel Co.

KAESTNER & HECHT CO. will be known in the future as the WESTINGHOUSE ELECTRIC ELEVATOR CO. The headquarters and plant of the new company will be located in Chicago, Ill. The company will operate as a separate unit of the Westinghouse Electric & Mfg. Co. The officers are E. M. Herr, chairman of the board of directors; F. A. Merrick, president; R. I. Phillips, vice-president and general manager; E. D. Kilburn, vice-president; W. S. Rugg, vice-president; N. G. Symonds, secretary; F. E. Craig, general auditor; H. F. Baetz, treasurer; and Frank C. Reed, general sales manager.

SIMMONS MACHINE TOOL CORPORATION, Menand, Albany, N. Y., has let contracts for renovating one of the large plants recently acquired by the company from the General Railway Signal Co. The building is to be changed so as to adapt it for use as a convention hall, stadium, and auditorium, and will be known as Menand Garden. It is to be equipped with every facility for conventions, such as the machine tool, foundry, and electrical conventions. It will be provided with power lines for use in operating machinery, and will be served by a railroad siding adjacent to the property. The building consists of two floors, 35,000 square feet each, of modern construction. The convention hall will seat 8000.

DRIVER-HARRIS CO., Harrison, N. J., manufacturer of nickel-chromium-iron alloy containers used in the carburizing process in casehardening, announces that in a suit brought by the company in the United States District Court for the Southern District of New York relating to infringement of United States Letters Patent No. 1,270,519, dated June 25, 1918, the suit of the Driver-Harris Co. was sustained and the Court decided that the patent was valid. The company, therefore, announces that the manufacturing or selling of carburizing containers which embody the invention described in the patent mentioned, as well as the use of such containers, if not made by the Driver-Harris Co., involves an infringement of this patent.

UNION CHAIN & MFG. CO., Sandusky, Ohio, manufacturer of elevating and conveying machinery and steel sprocket chain, has acquired control of the AMERICAN HIGH SPEED CHAIN CO. of Indianapolis, Ind. As a result of the merger of these two companies, the Union Chain & Mfg. Co. will be in a position to manufacture and market a complete line of steel sprocket chains. It is intended to move the machinery and equipment of the American High Speed Chain Co. to the Sandusky plant of the Union Chain & Mfg. Co. The executives of the company will be Fred Emmons, president and treasurer; J. C. Howe, formerly president of the American High Speed Chain Co., vice-president; Walter Hay, vice-president; and E. F. Emmons, secretary. W. A. McCosh, formerly with the American High Speed Chain Co., will also become connected with the Union Chain & Mfg. Co.

CARBORUNDUM CO., Niagara Falls, N. Y., has broken ground for the erection of a general warehouse and district sales office building in Detroit, Mich. The new building will be located at the east end of the Goodyear property at East Grand Boulevard and the Michigan Central tracks, facing the boulevard, on the tract recently purchased by the company. The building will be three stories and basement, of steel frame construction, 250 feet long and 110 feet deep, with a total floor space of about 50,000 square feet. The new warehouse will have its own railroad siding for the receipt of carload shipments from the company's Niagara Falls plant, and will carry complete stocks of grinding wheels, abrasive paper and cloth, polishing grain, and other abrasive and refractory products. It is expected that the building will be ready for occupancy early in January.